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ENGINEERING.—*Beach intelligence.*[1] MARTIN A. MASON, Beach Erosion Board, War Department.

In the first confusing and busy days of the war we at the Beach Erosion Board set out to find the part it could play in the all-out endeavor. Although its main role, in time, became that of a contributor to beach intelligence, this part was not clearly defined in the early days. Of course, at that time, even the idea of the need for such intelligence was new, so for some months the Board's work was limited to special problems concerning beach characteristics.

In the early stages little was known about the requirements for beach intelligence, nor were specific instructions included in the requests for intelligence. As a result, there was developed a series of approaches that gradually resulted in satisfactory intelligence as actual landing operations showed the need for specific types of information. Moreover, it developed that two broad types of reports were needed: a brief graphic report for strategic planning, and a fully detailed report for operations.

The strategic planning reports were prepared usually on order of the Joint Chiefs of Staff. This type of report was intended to give, in as concise form as possible, the physical characteristics of a fairly large area, usually an island, peninsula, or other major area, and to indicate where men and equipment could or could not be landed. An attempt was made to present the material on a single sheet, usually a hydrographic chart, to facilitate reading, and to keep the report unencumbered with detail. Often because of the briefness of the report, it was necessary to emphasize only the most important or hazardous physical features of the area. Such general information was called for as the extent and width of the fringing coral reef and the general characteristics of a coral beach. Brief coastal descriptions gave more specific information on each outlined area.

For the operational type report, the description of a beach area was undertaken in four sections and was accompanied by maps, charts, and aerial and ground photographs. The following data were usually furnished:

I. LOCATION AND EXTENT:
  A. Geographic coordinates of beach limits and length of beach.
  B. Importance of beach.
    1. With respect to physical characteristics.
    2. With respect to nearness of objectives.
  C. Description of local landmarks.

II. NEAR SHORE (includes area from 30-foot depth to low water line):
  A. Location of depth contours, usually 6-, 12-, 18-, and 30-foot depths.
  B. Location and depths over shoals, bars, etc.
  C. Location and description of anchorage areas.
  D. Description of bottom materials.
  E. Tidal information.
    1. Tidal range.
    2. Local peculiarities.

[1] Received April 9, 1947. This paper, and the one following by George W. Irving, Jr., are summaries of research for which the Awards for Scientific Achievement for 1946 were made by the WASHINGTON ACADEMY OF SCIENCES on March 20, 1947. Dr. Mason was given the award representing the Engineering Sciences in recognition of his service in erosion studies leading to successful beach invasions by Allied Armed Forces during the War. Dr. Irving received the Award for the Physical Sciences for his work in biochemistry, especially for his researches on antibiotics in tomato plants. The Award for the Biological Sciences was granted to Dr. Waldo R. Wedel, archeologist of the U. S. National Museum, in recognition of his contributions to the prehistory of human ecology in the Central Great Plains. Inasmuch as reports upon Dr. Wedel's work have been published in full by the Smithsonian Institution, it is not further summarized here.—EDITOR.

3. Direction and strength of tidal currents.

F. Winds.
1. Direction and occurrence.
2. Effect on tides and currents.

G. Waves and surf.
1. Direction of approach.
2. Characteristics.

III. Characteristics of Beach (the beach is defined as an area of unconsolidated material between the low water line and the upper limit of wave wash):
A. Length and width, at high and low water.
B. Composition, slope, and relative firmness (above and below high water).
C. Interruptions in beach.
1. Location.
2. Variations in beach characteristics along interruptions.
D. Direction of shore drift.
E. Local use of beach.
F. Location of any beach structures.

IV. Terrain Immediately Behind and Adjacent to Beach:
A. Topography.
B. Exits from beach proper.
C. Access to utilities and communication lines.

Fig. 1 shows one of the maps from a fairly early report. It is an enlargement to 1:50,000 of the Narbonne sheet of the French 1:80,000 series. On it, the beaches have been noted, numbered, and described briefly. The 6-, 12-, 18-, and 30-foot contours are shown and bottom gradients to the 12-foot depth are given at intervals. At the right, the shore line has been revised from aerial photographs.

The following pages of the report included the descriptive text and charts and photographs which illustrated these beach areas.

The preceding discussion has shown that a wide variety of information is required in preparing beach intelligence reports. Data for the Board's reports came from varied and widespread sources. All published literature was used as far as was possible. In it were included engineering, geological, geographic, and oceanographic journals; travel books; and sometimes even nature books on such subjects as bird life. Beach information was often found under very odd titles. All available publications of other Governmental agencies were used as were all available maps and charts published by United States agencies and by foreign powers. Recent aerial photographs were most valuable, and when available, lessened the importance of the widespread and sometimes rather vague literature sources.

Proper interpretation of such source data together with a knowledge of beach processes and the interrelationships between beach characteristics produced intelligence reports. The nature of the source data and the amount of interpretation required governed the reliability rating which could be given to the report of any particular beach area. The importance of the specialized knowledge, however, can not be overemphasized, even though some of this knowledge is not yet concrete or set down experimentally in quantitative terms. Broadly speaking, interpreting and correlating known beach data into a complete descriptive picture, required some knowledge of the following items:

1. The characteristics of waves, currents, and tides; and the effect of meteorological conditions on these phenomena.
2. The probable relationship between the nature of source deposits and the composition, width, and surface features of the beach.
3. The relationship of beach slope to such factors as composition, surf, and exposure.
4. The relationship of near-shore bottom gradients to surf intensity and characteristics.
5. The relationship between predominant shore currents and beach configuration.
6. The relationship of beach firmness to such items as composition, season, or exposure of the beach.
7. The relationship between such special beach features as beach cusps, and composition, season, or surf.
8. The interpretation of beach and underwater features and the determination of underwater depths from aerial photographs.

For an insight into these relationships, it was necessary to draw on wide experience in studying beaches along our own coast and on data which verified some of the trends of these relationships. For example, beach slopes are of major importance in some landing operations and yet specific information on slopes was often lacking. It was, however, often possible to predict the order of magnitude of the slope from knowledge of particle size, exposure of the beach and other factors.

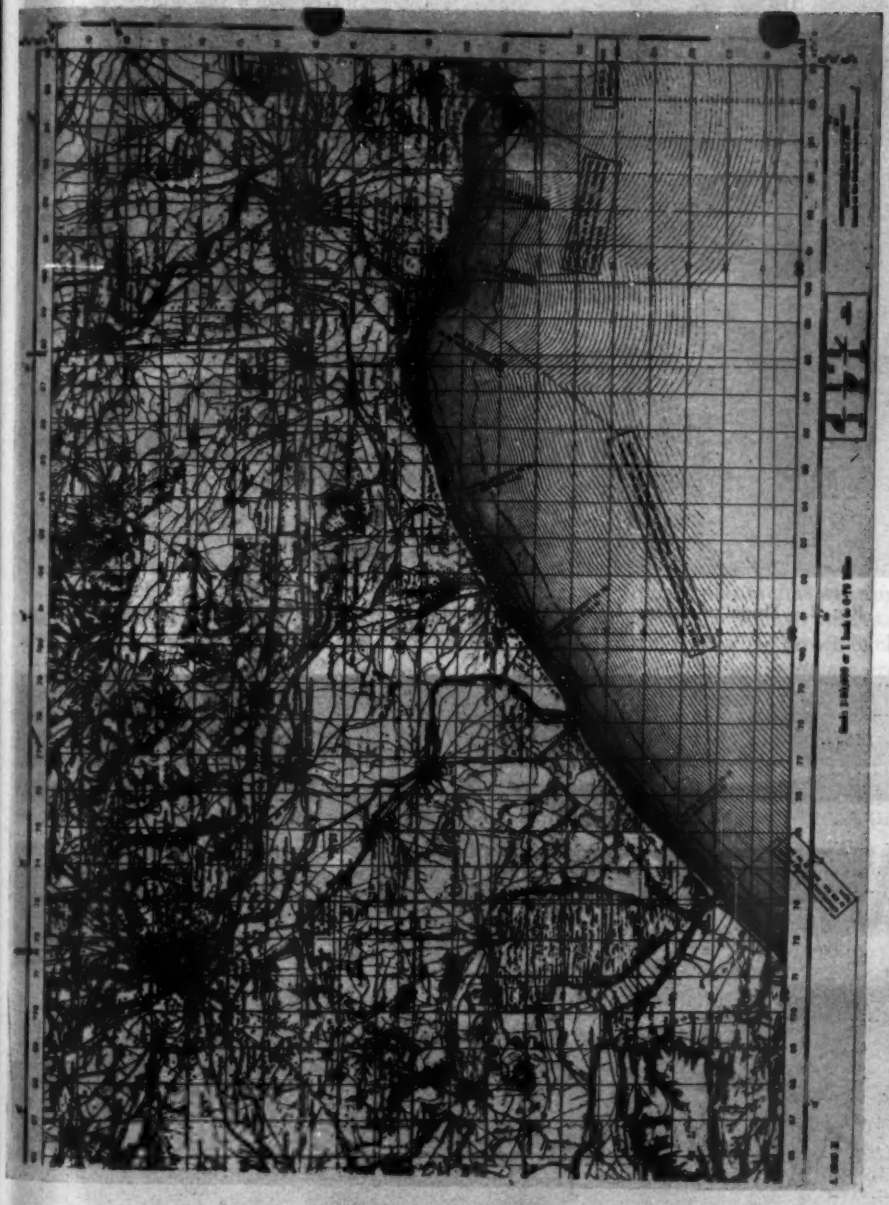

FIG. 1.—Typical map from early study showing method of reporting beach and near-shore information. Note revision of shore line at right of picture from aerial photographs.

FIG. 2.—Model of sunken Liberty ship aligned as incorporated in artificial harbor. View prior to test under storm-wave forces.

FIG. 3.—Model of sunken Liberty ship after test under storm-wave forces. Note displacement of model and erosion under bow.

This brief description of the work involved in preparing beach intelligence has indicated some of the problems that had to be overcome. The problems, of course, varied in degree with the amount and the reliability of the source data available. Beach intelligence, when prepared at a point far removed from operations, is still to some extent an art and not a science.

In addition to preparing beach intelligence reports, there was conducted laboratory experimental work which had direct bearing on the war effort. These experiments covered such items as the determination of depths over offshore bars or other bottom discontinuities and the characteristics of waves approaching a beach.

Other agencies were aided by wave tank experiments to determine the effects of storms and wave forces on pontoons or sunken ships designed as artificial harbors. Figs. 2 and 3 show before and after views of one of the test runs of storm waves on sunken model Liberty ships. In these experiments, an attempt was made to determine the best method of aligning the sunken ships to withstand wave forces. These tests were confirmed by experience during the Normandy invasion.

Acknowledgment is made of the great aid of Dr. W. C. Krumbein, Jay V. Hall, and Mrs. Clara Edmunds, my colleagues in this work.

BIOCHEMISTRY.—*The significance of tomatin in plant and animal disease.*[1] GEORGE W. IRVING, JR., U. S. Bureau of Agricultural and Industrial Chemistry.

The elucidation of the biochemical nature of disease resistance in plants is a subject of challenging interest and one that is engaging the attention of this and other laboratories. Nearly all plants are prey to certain bacterial, fungal, or virus diseases. In many cases such diseases are responsible for major crop failures, which result in economic losses to the farmer, reduction in the supply of farm produce, and, ultimately, in increased costs to the consumer. For these reasons, plant-disease control has long been a problem of paramount importance to the agricultural scientist. Great progress in plant-disease control has been made through the development and application of bactericidal and fungicidal chemicals and through improvements in general farm practice. High in importance in minimizing the inroads of disease in plants has been the development, through intensive plant-breeding experiments, of varieties of economically important plants that are highly resistant to specific disease-causing organisms. By such means it has been possible to develop, in the case of many plants, varieties that will grow and produce in spite of infection (*1*, *2*). As a result of these experiments the plant geneticist can now provide plant-disease investigators with, for example, two tomato plants that will appear almost identical as to foliage and as to quality and size of fruit when grown in clean soil. However, when these plants are grown side by side in soil that is infested with the fungus *Fusarium oxysporum* f. *lycopersici*, one will wilt and die while the other will remain vigorous and produce fruit. One of these tomato plants is able to resist infection by *Fusarium* and survive, while the other is not able to resist the infection and succumbs. What is it then, in the chemical make-up of the plant that survives infection that is responsible for its resistance to wilt disease? This is the question for which it is hoped a reasonable answer can be found. It is believed that a full understanding of the chemical factors involved in conferring resistance upon a specific plant (the tomato) toward a specific disease organism (*Fusarium*) may provide clues upon which new and perhaps better methods for controlling disease in the tomato plant can be based. It is possible, further, that the knowledge gained in the biochemical study of disease resistance in the tomato plant may reveal factors of general significance to aid in the elucidation of the disease resistance mechanism of other plants to other pathogens.

[1] Received April 24, 1947. See footnote 1 of preceding article.

Investigations were initiated in this laboratory on the basis of a simple working hypothesis, namely, that certain tomato varieties are resistant to *Fusarium* wilt because they are able to produce an antibiotic agent or agents in sufficient quantity to inhibit the growth of the invading fungus. Early in the work partial substantiation of this hypothesis was obtained (*3*). It was found that the resistant tomato plant does elaborate a substance that markedly inhibits the growth of *Fusarium in vitro*, that the substance could be concentrated by suitable fractionation procedures, and that it satisfied the prerequisites of an antibiotic agent. This antibiotic agent from the tomato plant is now designated tomatin.[2]

During the past two years intensive efforts have been made to explore as fully as possible the many interesting lines of investigation that the discovery of tomatin has suggested. Research has been directed with four main objectives in view: (*a*) to isolate tomatin in the pure state and, once this is accomplished, to characterize it chemically; (*b*) to determine the antibiotic spectrum of tomatin, that is, to determine which microorganisms it inhibits and which it does not; (*c*) to ascertain the role, if any, played by tomatin in protecting tomato plants against *Fusarium* wilt; (*d*) to investigate the possible occurrence of tomatin or tomatin-like substances in other plants. Much of this program still remains to be accomplished, but substantial progress has been made toward the achievement of each of the four objectives. It is known that tomatin is a water and alcohol soluble, remarkably heat stable, organic compound of relatively low molecular weight (*3*, *5*); that it inhibits many other organisms besides *Fusarium*, among them bacteria, other fungi and yeastlike forms (*5*, *6*); that tomatin or similar substances occur in plants like the potato, sweet potato, cabbage, and pepper but are absent from a majority of the other plants that have been examined (*5*); and finally that tomatin occurs in wilt-susceptible as well as in wilt-resistant tomato plants but probably to a greater extent in the latter (*3*, *7*).

The discovery that tomatin is present in wilt-susceptible tomato plants was somewhat disappointing since, obviously, it would have been most attractive to be able to explain the susceptibility of certain tomato plants to wilt on the basis of the complete absence of tomatin from such susceptible varieties. Since this is not the case, attention was turned to the investigation of the effect of infection by *Fusarium* on the tomatin level in resistant and susceptible tomato plants. In these experiments it was found on the one hand, that a high level of tomatin is maintained in resistant tomato plants able to survive even though they are badly infected; on the other hand, it was found that tomatin gradually disappears from susceptible plants as invasion by *Fusarium* proceeds and that tomatin is completely absent from wilted and dying plants.

From these results it has been concluded tentatively that wilt-resistance or wilt-susceptibility in the tomato plant does not necessarily depend upon the presence or absence of tomatin, but rather upon the rate at which the plant is able to elaborate tomatin as the need for this protective substance arises. If the metabolic processes of a given tomato variety are capable of producing tomatin at a rate sufficient to

[2] The difficulty that has been experienced in selecting a suitable, unique name for this antibiotic agent demonstrates the pitfalls that confront those who would attempt to coin distinctive names for unidentified substances of biological origin. The substance was first named "lycopersicin," a term derived from *Lycopersicon*, the genus to which the tomato plant belongs. It was soon learned, however, that the term lycopersicin had been used previously to designate the red pigment of the tomato (*4*), and, although the use of the term in this sense was abandoned immediately owing to the more general acceptance of the term lycopene, it was considered wise, nevertheless, to abandon its use as a designation for the antibiotic agent from the tomato plant in order to avoid any possible confusion. After much deliberation the antibiotic was renamed "tomatin," derived simply from the name tomato. Very recently it has been learned that the term tomatin has also been used previously to designate an alcoholic beverage of foreign manufacture. In this instance, however, there seems to be little likelihood of confusion, and it is anticipated that the term tomatin will be retained to designate the antibiotic agent until its eventual isolation and identification may make it preferable to rename it in accordance with accepted chemical nomenclature.

maintain a protective level in the plant, then that variety will be resistant to wilt; if an adequate rate of tomatin production can not be maintained, the variety will be susceptible to wilt. While this conclusion is plausible in the light of the data, conclusive proof of its validity has not yet been obtained. It is known that wilting is accompanied by a disappearance of tomatin, but it can not be ascertained on the basis of the information now available whether tomatin disappears because the plant wilts or the plant wilts because tomatin disappears. The answer to this question, and an investigation of the mechanism whereby tomatin is produced by the plant, are among the more interesting problems for future investigation.

As has been mentioned, the antibiotic effectiveness of tomatin is not confined to the fungus *Fusarium*. It does, in fact, inhibit much more strongly cultures of certain of the fungi that cause disease in humans; among the organisms inhibited are those responsible for the dermatophytic infections such as ringworm and athlete's foot, and the more serious, often systemic infections such as blastomycosis, coccidioidomycosis, and histoplasmosis (*5*, *6*) (Tables 1 and 2). To many this is perhaps the most interesting aspect of the work on tomatin, since a fungistatic agent suitable for parenteral use in humans is sorely needed by the medical profession. This is understandable, since no successful therapy exists at present for either the mild local infections or the serious systemic fungus infections in man. Tomatin is by no means the only antibiotic agent that possesses marked fungistatic properties, but those that have been tested heretofore are of limited clinical usefulness because of their toxicity (*8*). Accordingly, vigorous efforts are being made to ascertain the potentialities of tomatin for the treatment of fungus diseases in humans. The knowledge that tomatin inhibits these pathogenic fungi in culture represents only the first step in such an investigation. To be useful for human therapy tomatin must be shown to be of sufficiently low toxicity to permit safe administration or application in man and to be effective against these same fungi in man. Whether tomatin possesses desirable properties in this regard is now being determined in cooperative experiments with the Duke University School of Medicine. These experiments have not yet progressed to the point where definite conclusions regarding the toxicity or *in vivo* effectiveness of tomatin can be drawn.

All the lines of research mentioned earlier in this report are being prosecuted as actively as possible. However, in all this work, and in plans for the future extension of these investigations, the isolation of tomatin in the pure state and its identification are of first importance. It is for this reason that the major current effort is being expended in this direction. Once tomatin has been obtained pure and its chemical nature are known it is probable that many of the present uncertainties regarding its possible role in the disease resistance mechanism of tomato plants and its possible effect upon the human organism can be clarified in direct, uncomplicated experiments.

The author takes pleasure in expressing his appreciation and indebtedness to his friends and associates Dr. Thomas D. Fontaine, Dr. S. P. Doolittle, Dr. Roberta M. Ma, and Mrs. Janet B. Poole, whose enthusiastic efforts have been largely responsible for the results presented in this report.

TABLE 1.—ORGANISMS WHOSE GROWTH IS COMPLETELY INHIBITED BY THE PRESENCE OF 1 UNIT TOMATIN PER ML. OF CULTURE MEDIUM

Organism	Disease and remarks
Candida (Monilia) albicans	Moniliasis (thrush, bronchomycosis).
Cryptococcus neoformans *Debaryomyces histolytica*	Cryptococcosis (European blastomycosis, torulosis).
Trichophyton mentagrophytes *Trichophyton interdigitale* *Trichophyton rubrum* *Trichophyton gypseum* *Epidermophyton floccosum* *Microsporum audouini* *Achorion gypseum* *Achorion schoenleinii*	The dermatomycoses (ringworm, athlete's foot, etc.).
Blastomyces dermatitidis	North American blastomycosis.
Coccidioides immitis	Coccidioidomycosis.
Histoplasma capsulatum	Histoplasmosis.

TABLE 2.—ORGANISMS WHOSE GROWTH IS PARTIALLY INHIBITED BY THE PRESENCE OF 1 UNIT TOMATIN PER ML. OF CULTURE MEDIUM

Organism	Disease and remarks
Fusarium oxysporum f. lycopersici	Tomato wilt.
Fusarium oxysporum f. pisi	Pea wilt.
Fusarium oxysporum f. conglutinans	Cabbage yellows.
Fusarium oxysporum f. lini	Flax wilt.
Actinomyces scabies	Potato scab.
Sporotrichum schenckii	Sporotrichosis.
Monosporium apiospermum	Maduromycosis (Madura foot, mycetoma)
Aspergillus niger, *Aspergillus clavatus*, *Penicillium notatum*	Rarely pathogenic.
Staphylococcus aureus	Gram positive.
Bacillus cereus	Gram positive.
Bacillus mycoides	Gram positive.
Bacillus subtilis	Gram positive.
Escherichia coli	Gram negative.

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BIOPHYSICS.—*Harmony among vital substances.*[1] LUIS FELIPE VEGAS, Ministry of Public Works, Caracas, Venezuela. (Communicated by ALEXANDER WETMORE.)

As vital substances we here consider those, such as water, blood, etc., which are indispensable to the existence of man and the majority of living things. We have also placed under this heading those substances which are produced by a living organism, such as the aqueous and vitreous humors of the eye, or those of significance in the digestive process as saliva and hydrochloric acid. Finally, we have included those which are important in the conservation of species, as milk, etc.

From the chemical point of view, it is very difficult to establish a relationship of similarity between these substances. This is clearly seen in the case of hydrochloric acid and albumen, in that the simplicity of the former (HCl) is in striking contrast to the complex form of the latter, which, according to A. Gautier, is: $C^{250}\ H^{403}\ N^{67}\ O^{81}\ S^{3}$.

If we take into consideration the physical properties of these substances, we notice that they have certain similarities, since many are liquid at ordinary temperature, and all, in conformity with the latest theories, may have similar electronic arrangements. However, the similarity we shall discuss is a new aspect of the close relationship that exists between these substances. In 1937, we published a paper entitled *A study of the relations which exist between specific inductive capacity, the index of refraction of light, and density.*[2] In that

[1] Revised from the author's article *La armonía entre las sustancias vitales*, Bol. Soc. Venezolana Cienc. Nat. 9 (59): 163–166. 1944. Translated from the Spanish by Pedro J. Baldó and Armando Lazzari. Received February 5, 1946.

[2] Revista Colegio Ingenieros Venezuela 14 (123): 133–144. 1937.

paper we pointed out the relationship existing between the indices of refraction of groups of substances and their respective densities. This relation, with which we are now concerned, came under the caption of "Second Law," which reads: "There exists in a given substance a constant relation between the index of refraction raised to the nth power and its density. I being the index of refraction, and D the density, we have: I^N/D = a constant. For each value of N there are an undetermined number of group-forming substances. To these groups we may give, as a characteristic, the same number which expresses the value of N. Thus, group 2 will be formed by all substances where $N=2$, and group 3 by those where $N=3$, etc."

GROUP 3

Substance	Refractive index I^a	I^3	Density D (relative to air)	$\frac{I^3}{D}$
Water	1.3330	2.3686	772.026	$(3.06)10^{-3}$
Human blood	1.3540	2.4823	815.921	(3.04) "
Albumen	1.3510	2.4658	804.331	(3.06) "
Blood serum	1.3483	2.4511	794.277	(3.08) "
Urea	1.4840	3.2680	1,032.482	(3.16) "
Succinic acid	1.5338	3.6082	1,201.856	(3.00) "
Vitreous humor	1.3400	2.4061	777.262	(3.09) "
Aqueous humor	1.3400	2.4061	777.262	(3.09) "
Saliva	1.3390	2.4007	777.958	(3.08) "
Hydrochloric acid†	1.4100	2.8032	920.340	(3.04) "
Woman's milk	1.3484	2.4516	798.662	(3.07) "
Cow's milk	1.3500	2.4604	798.298	(3.08) "
(dl) Lactic acid	1.4414	2.9947	965.970	(3.10) "
Urine	1.3400	2.4061	787.316	(3.05) "
(1−α) Arabinose	1.5670	3.8477	1,225.831	(3.14) "
1−Xylose	1.5440	3.6807	1,179.427	(3.12) "
Average of the quotients				(3.07) "

[a] The indices of refraction which appear in both tables are referred to sodium light.

† Concentrated aqueous solution. However, pure hydrochloric acid (liquefied hydrochloric gas) also belongs to group 3. From liquefied hydrochloric gas at a temperature of 16° C we get: $I=1.252$; $I^3=1.9625$; $D=645.785$; $I^3/D=(3.04)10^{-3}$.

If we now try to find out to which of the groups the vital substances belong, we shall see that the few of them which we have been able to investigate come under groups 3 and 2, as they are listed herewith in tabular form.

In both tables, opposite the name of every substance, we find: first, its index of refraction relative to air; second, the same index raised to the nth power; third, its density relative to air[3]; and fourth, the ratio I^N/D.

It is interesting to note that the substances such as urea, succinic acid, arabinose, and xylose, the quotients of which greatly differ from the average, are all anisotropic. That is, their physical properties differ for every direction about a point and, in a general way, they do not obey the Snellius-Descartes laws of refraction.

In the case of urea, which is uniaxial, the ordinary index was used, and the intermediate index for the other three, which are biaxial.

The inclusion of hydrochloric acid and water in the table of group 3 does not permit applying the term "organic substances" to this group. A different denomination being necessary, the denomination "vital substances" was adopted.

GROUP 2

Substance	Refractive index I	I^3	Density D (relative to air)	$\frac{I^3}{D}$
Sardine oil	1.4802	2.1909	717.246	$(3.05)10^{-3}$
Herring oil	1.4780	2.1845	711.678	(3.07) "
Menhaden oil	1.4800	2.1904	716.937	(3.05) "
Cod-liver oil	1.4790	2.1874	713.070	(3.07) "
Shark-liver oil	1.4743	2.1735	718.174	(3.02) "
Dolphin oil	1.4688	2.1573	717.169	(3.01) "
Seal oil	1.4741	2.1729	714.617	(3.04) "
Spermaceti	1.5030	2.2590	730.858	(3.09) "
Lard oil	1.4686	2.1568	705.491	(3.06) "
Sheep's-foot oil	1.4680	2.1550	709.590	(3.04) "
Neat's-foot oil	1.4730	2.1697	707.656	(3.06) "
Horse's-foot oil	1.4680	2.1550	706.109	(3.05) "
Average of the quotients				(3.05) "

It may interest physiologists to know that acetone belongs to group 2, in which the fats are grouped. From acetone we get: $I=1.3593$; $I^3=1.8477$; $D=611.755$; $I^3/D=(3.02)10^{-3}$

Although we have said that I^N/D is a constant, we find small differences in the lists of quotients. This is probably due to the fact that (besides what has already been said about anisotropic substances) the same sample was not always used in meas-

[3] To obtain the densities referred to air, multiply the density referred to water by 773.395.

uring the index of refraction and the density of the substances. It could also be explained by the fact that the temperature was not the same at the times when the index of refraction and density were being measured. It may also be the result of both causes acting simultaneously. Nevertheless, in the case of water, the index of refraction (1.33299) and the density (0.99823 or 772.026 relative to the air) were very carefully measured at a fixed temperature of 20° C. This determination allows us an accurate value for the term I^N/D and an approximate value could also be obtained by computing the average of all the values for this term in both groups. Doing so, we find that the average value obtained is almost identical to the one corresponding to water, differing, only by 11 in the seventh decimal place.

Quotient I^3/D for water	0.0030679
Average of all the quotients	0.0030668

CONCLUSION

The relation shown in the tables between the index of refraction and density reveals the existence of a similar internal arrangement among the substances belonging to the same group. As the constant $I^N/D = (3.0679)10^{-3}$ is the same for both groups it is quite possible that this indicates the existence of some equilibrium or arrangement between both groups.

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ETHNOLOGY.—*Further light on the Delaware Indians as women.*[1] C. A. WESLAGER, Wilmington, Del.

The author's first essay relating to the feminization of the Delaware Indians by the Five Nations Iroquois reopened an old subject which aroused several correspondents to concur and dissent with the views expressed and stimulated other papers on the same theme.[2] In view of the divergence of opinion the present essay is subjoined to the first as a means of clarifying the writer's position and of introducing new data in support of the following premises:

1. The Five Nations in effect conquered the Delaware prior to 1712, forcing them to pay tribute. Either as a direct result of the conquest or through some subsequent act on the part of the Delaware, they were "feminized" by the Iroquois.

2. In the position of "women" the Delaware were deprived of certain masculine prerogatives and remained in the status of partial vassalage until 1756, when, under the leadership of the chief Tedyuskung, they were emancipated.

3. During the period when they were recognized as "women," not only by the Iroquois but also by themselves and other Indian tribes, the Delaware were not accorded treatment as honored matrons. In fact, they were often humiliated and treated contemptuously.

4. Other tribes during the same period differentiated between the status of warrior "men" and noncombatants allegorically termed "women." However, the position of women in tribal society differed areally, and females were not necessarily considered as inferiors.

The data offered in the original paper and the material herein presented must be

[1] Received May 26, 1947.

[2] WESLAGER, C. A. *The Delaware Indians as women,* Journ. Washington Acad. Sci. **34**: 381–387. 1944.

SPECK, FRANK G. *The Delaware Indians as women,* Pennsylvania Mag. Hist. and Biogr. Oct. 1946: 377–389. In addition, a manuscript has been submitted to the Pennsylvania Archaeologist by Anthony Wallace entitled *The status of the Delaware Indians in the Iroquois Confederacy.* The writer had the privilege of reading this essay, which at this writing has not yet been published.

accepted solely as accounts found in State records, lacking in ethnographic detail and leaving many questions unanswered. Nevertheless, the colonial records stand among few contemporary accounts accessible today and must be given full credence. The writer does not agree that these records are of questionable value because they were written by white scribes untrained in ethnic observation. Actually, the Indian speeches were interpreted by men thoroughly familiar with native institutions and dialect, and in some cases the interpreters themselves were of Indian descent. Indian relations prior to 1800, especially in Pennsylvania, were of great moment, and after carefully perusing the provincial records it is my opinion that native ideology was preserved as nearly as possible. In negotiations between whites and Indians, the Indian custom of exchanging wampum belts predominated; the figurative language employed was in accordance with native expression as was the method of protracted deliberation during negotiations.

Apart from the colonial records information derives from other accounts which epitomizes the relations between whites and Indians. For example, the practice of the Five Nations in demanding tribute from subjugated tribes is succinctly described by a contemporary author and observer who wrote: "All the Nations round them have for many Years intirely submitted to them and pay a yearly tribute to them in Wampum; they dare neither make War nor peace without the consent of the Mohawks [i.e., Five Nations]. Two old Men commonly go about every Year or two to receive this Tribute; and I have often had the Opportunity to observe what Anxiety the poor Indians were under while these two old Men remained in that part of the country where I was."[3]

In a separate volume, now in preparation, I have discussed the bead tribute paid the Five Nations by the Conoy and Nanticoke.[4] Of the Conestoga (Susquehannah-Minquas) it was recorded that they "actually pay tribute to the Five Nations, and either from natural affection or Fear are ever under their influence.[5]

Of the Delawares, it was written in 1698: "That the Delaware Indians live at Minguannan about nine miles from the head of Elke River & fifteen miles from Christeen & Thirty miles from Susquahanah & are about Three hundred red men & *are tributary to the Senecars* [Seneca] and Susquehannahs fifty of them living at Minguhanan & the rest upon Brandywine and Upland Creeks."[6]

This deposition specifically refers to the Unami, and the area described is in northern Delaware and southeastern Pennsylvania. However, Munsi and/or Mahicanni are referred to as the vanquished in the following statement made by the Dutch navigator De Vries, based on his observations made prior to 1650 in the Hudson River region: "This tribe of Indians [Munsi or Mahicanni] was formerly a powerful nation, but they are brought into subjection, and made tributaries by the Maquas [Mohawk]."[7]

Again he writes: "The Maquas, as before mentioned, and who hold most of the others along the river to Fort Amsterdam under tribute."[8]

The most significant recorded payment of bead tribute by the tributary Delaware took place at a Council at White Marsh, May 19, 1712, in which the principal participants were Governor Gookin, the sachems Sasoonan, Scollitchy, Ealochelan, and eleven other Indians. Scollitchy's remarks, with my italic, appear in full below[9]:

> That many years ago being made Tributaries to the Mingoes or 5 Nations & being now about to

[3] COLDEN, CADWALLADER. *The history of the Five Nations of Canada* 1: xviii. Reprinted A. S. Barnes, New York, 1904.

[4] *An early history of the Nanticoke Indians*, shortly to be published by the Pennsylvania Historical Commission.

[5] *Minutes of the Provincial Council of Pennsylvania* 3: 204. This work published by the State, 1851–52, was issued in 16 volumes. The first three volumes were printed by Jo. Severns & Co., Philadelphia, the remainder by Theo. Fenn & Co., Harrisburg. Hereafter reference will be made to this source as "Minutes."

[6] *Maryland archives* 16: 520. Published by Historical Society of Maryland.

[7] DE VRIES, DAVID PETERSON, *Voyages from Holland to America*, trans. H. C. Murphy. New York. 1853. Typed copy in possession of Wilmington Institute Free Library, 92.

[8] *Op. cit.*, 103.

[9] *Minutes* 2: 546–547.

visit them, they thought fitt first to wait on the Govr. & Council to lay before them the Collecon they had made of their tribute to offer and to have a conference with the Govr. upon it, they therefore laid on the floor 32 belts of Wampum of various figures, and a long Indian pipe called the Calamet with a stone head, a wooden or cane shaft & feathers fixt to it like wings with other ornaments.

This pipe they said, upon making their submissions to the five Nations, *who had subdued them & obliged them to be their tributaries*, those nations had given to these Indians to be kept by them, that at all times thereafter, upon shewing this pipe where they Came, they might be known to be the friend & subjects of the five Nations, and be received by them when they Came amongst them.[10]

Then they proceeded to open their Belts & Declared for what purpose & with what intentions each of them particularly was sent.

The first belt they said was sent by one, who at that time of their agreemt. or submission was an Infant & Orphan, the son of a Considerable man amongst them.

The second Belt was presented by one who was also the son of one then Deceased, but Desired to be taken in & accounted as one of the children to those of the five nations, that he might have clear & free passage amongst them.

The third belt is presented by another Orphan who desires the same.

The fourth by a son of one then living & sends it so large to Express his respect, as that it shall Cover the Pipe or Calamet.

The fifth is to Inform that tho' the principal of the family that sends it be dead, Yet they Continue their Obedience & shew their Intention by this present.

The Sixth sent by another who desires to be regarded as a Child of the 5 Nations.

The seventh by a woman who Desires to be Considered according to her sex; desires peace that she may eat & Drink in Quiet & is always willing to pay tribute.

The Eighth by a woman to the same purpose, desires she may make & keep fires in quiet.

The Ninth by a woman to the same purpose that she may plant & reap in quiet.

The tenth by a woman, desires peace & ease from ye rising of the sun to his going down.

The Eleventh by a woman, Desiring they may always have fair weather & sunshine with ye 5 nations.

The Twelfth by a woman, that a long time ago they made a peace & Desired that it may always be kept strong and ffirm.

The thirteenth by a woman that formerly the five Nations lived amongst us, that tho' now they are at a Distance they may live Quiet.

The fourteenth by a woman Desiring their Houses may be the same.

The fifteenth by a woman, that they are glad they can enjoy peace so quietly to bed and rise in the same manner.

The sixteenth, That formerly some french Inhabited among the five Nations, but a War breaking out, the five nations had Destroyed them, they pray that they may always do ye same.

The Seventeenth that they shall always keep an Open & Clean House for the 5 Nations & be ready to receive them.

The Eighteenth That as they have had Houses among the 5 nations, they Desire they may always have the same privilege.

The nineteenth That they may build their houses firm, as to continue there long, and not be obliged to make them slight, as if they were on all occasions to fly.

The twentieth to the same purpose.

The twenty-first that they build Houses & keep fires without molestation.

The twenty second that they have built Houses, rest securely in them & do not Doubt but they shall have the same liberty.

The Twenty third, That formerly one of the Chiefs of those Nations came down & Dwelt among ym., that they Regarded him always as their superior & one of them.

The twenty fourth That when they arrive, they would fully hear & understand them; and that they may have Liberty to pass & repass in all places.

The twenty-fifth that they may make Racoon & other Blankets to cloathe them & sett Down in them in peace.

The twenty sixth that they are sorry the french should Destroy any of them, for that they take the Loss of any of them to be the Loss of themselves.

The twenty seventh That having heard that in their Warrs they had obtained a victory over the french, they were Glad & Congratulated them upon it.

The Twenty Eight that they are glad their young men have the Privilege of going far from their own habitacons to hunt abroad in peace & that they can return home & Eat & Drink & Enjoy themselves.

The Twenty Ninth that they are Glad they can go in peace to hunt far abroad, that they may return home & Eat quietly meat to make them strong.

The Thirtieth they are Glad they can hunt & bring home relief to their poor relacons.

The Thirty first They are sorry that their Children as well as theirs die; that their Eyes have been shutt up by it, that they could not see the Sun; Desire they may be opened & that all may be cheerful.

The Thirty second They hope they will be pleased with the presents now offered, and that their children will have it in Everlasting Remembrance; *these last 24 were all sent by women*,

[10] The Five Nations gave the Nanticokes a belt of white wampum, containing three hands wrought in black beads as a pledge of peace when they made them tributary. It served the same purpose as the pipe did for the Delawares. *Minutes* 2: 246.

the Indians reckoning the paying of Tribute becomes none but women & children.

From the tone and content of the messages accompanying each string of wampum, it appears that the tribute paid by the Delaware also served as gifts to confirm certain understanding previously agreed upon by the two tribal groups. This entire institution of bead tribute is characterized with undertones and nuances that are lost upon us today, and in view of the scant information, the writers prefer to defer offering further interpretation except to emphasize the references to "submission" in the quotation just cited. There can be little doubt that a conquest occurred, although all writers have not accepted this as fact. For example, Heckewelder wrote: "It is admitted by the Lenape themselves that they and their allies were made women by the Iroquois. But how did this happen? Not surely by conquest or the fate of battle."[11] Certainly the admission by the Delaware chiefs: Scollitchy (in the above quotation), Sassoonan, Tedyuskung, and Beaver, whose statements were previously quoted[12] as well as the depositions herein cited, leaves no doubt that a conquest took place.

Additional evidence can be added from the Five Nations. An Iroquois sachem called The Belt, addressing Governor Robert Morris at a Council held at Carlisle, January 16, 1756—interpreted by Conrad Weiser who understood Mohawk—referred to "the Delawares who were a tribe conquered by and entirely dependent upon them."[13] The next year at Lancaster, Little Abraham, a Five Nations speaker declaimed: "We must inform you that in former times our Forefathers conquered the Delawares and put petticoats on them."[14]

The question that has long perplexed students is why the Five Nations singled out the Delawares and reduced them to womanhood whereas other subjugated tribes merely paid wampum tribute without sacrificing honor or status.

L. H. Morgan, who made the first and classic analysis of Iroquois society, offers a traditional explanation not lacking in plausibility:

> After they [the Delawares] had been subdued and had acknowledged their dependence by sending tributary wampum, they made an inroad upon a western nation under the protection of the Iroquois, notwithstanding their knowledge of the treaty and a prohibition against its infringement. A deputation of Iroquois chiefs went immediately to the country of the Delawares and having assembled the people in council they degraded them from the rank of even a tributary nation. Having reproved them for their want of faith, they forbade them from ever after going out to war, divested them of all civil power, and declared that they should henceforth be as women. This degradation they signified in the figurative way of putting upon them the Gä-kä-ah, or skirt of the female, and placing in their hands a corn pounder thus showing that their business ever after should be that of women.[15]

This statement, if true, would change somewhat the sequence of events in relation to the feminization. It could mean in effect that after their defeat the Delawares, like the other subjugated tribes, merely paid the Iroquois wampum tribute. But, unlike the other tributary nations, they performed a warlike act without the consent of their overlords, and for this breach of contract, they were degraded to the ignominious position of women, their independence forfeited.

It must not be overlooked that Delaware liberation from their position as womenfolk was a product of an era in which white pressures were being exerted on Indian society as part of political intrigue. The Five Nations yielded to English influences, especially through the offices of Sir William Johnson, who was appointed by the Crown to supervise Indian affairs in the Northern

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[11] HECKEWELDER, JOHN. *Customs, manners etc.*: xxvii, Philadelphia, 1876.

[12] Weslager, *op. cit.*

[13] *Minutes* 7: 3.

[14] *Minutes* 1: 540. An admission by the Delaware made to Sir William Johnson, July 1756, explains why they were so easily led astray by the French in attacking the English. "We are looked upon as Women, and therefore when the French came amongst us, is it to be wondered they are able to seduce us?" *Documents relative to the colonial history of the State of New York*, ed. E. B. O'Callaghan, 7: 157. Albany, 1856.
Gideon Hawley, Dec. 27, 1755, quoted the Delaware as follows to Sir William Johnson: "We are women, our uncle must say what we must do, he has the Hatchett and we must do as he says, 'tis true Brother We have not the hatchet. We are poor Women and have got out of temper." *Op. cit.* 48.

[15] MORGAN, LEWIS H. *League of the . . . Iroquois:* 328. New York, 1922.

Department. The Shawnee, Delaware, and a number of western tribes remained within the French sphere of influence. The outbreak of hostilities following Braddock's defeat demonstrated to the English that the Indians held the balance of power, and ultimate victory would come to the army controlling the most powerful Indian allies. Sir William, shrewd in politics and well-versed in Indian affairs, realized that the way to win over the Delaware lay not only through presents, flattery, and settlements of land disputes, but chiefly by according them recognition as a nation of warrior "men." This meant removing their skirts at least in the name of the Crown, hoping that his action would influence the Five Nations to do likewise. Accordingly, on April 17, 1756, in a letter to the Lords of Trade in London after a meeting with Delaware representatives, he wrote: "I concluded this Treaty by Taking off the Petticoat, or that invidious name of Women from the Delaware Nation which hath been imposed on them by the 6 Nations from the time they conquered them."[16]

Sir William's actual speech to the Delaware was as follows: "I do in the name of the Great King of England your father declare that henceforward you are to be considered as Men by all your Brethren the English and no longer as Women, and I hope that your Brethren of the 6 Nations will take it into consideration follow my example and remove this invidious distinction which I shall recommend to them."[17]

As has already been pointed out, the Iroquois eventually extended certain rights of manhood to the Delaware, but only after Tedyuskung, with Quaker support, forced their hand.

Turning for a moment to the Indian concept of the "man" warrior opposed to the "woman" nonwarrior, one must remember that the status of the female differed areally. Among certain tribes her position appears to have been no better than chattel. Elsewhere, she enjoyed a position of influence; for example, "queens" were known to have "reigned" in several Eastern tribes.[18]

In negotiations with colonial authorities, Indian women were frequently allowed a voice, as, for instance, during a meeting with the Shawnee, June 30, 1707. Addressing Governor Evans, "an Indian spoke in behalf of the women: We are concluded in the alliance before spoken of, as well as our men, so we ask the Govrs. Protection and desire the Govr. will accept this present of skins which freely we make him as a Testimony of our kindness." To which the governor replied that he would treat them as friends and sisters."[19]

On June 16, 1710, during a meeting between the Pennsylvania authorities and Tuscarora chiefs, it was recorded: "They signified to us By a Belt of Wampum which was sent from their old Women, that those Implored their friendship of the Christians & Indians of this Govmt. that without danger or trouble they might fetch wood & water."[20]

Several quotations serve to illustrate the high regard for "men" in the guise of warriors.

On July 2, 1754, the famous Mohawk speaker Hendrick addressed Governor James Delacey, urging him to take up arms against the French and saying: "Look at the French, they are Men; they are fortifying everywhere. But we are ashamed to say it. You are all like women, bare and open and without any Fortification."[21]

In 1756 the Iroquois chief Scarroyady urged Governor Morris to declare war on the renegade Delaware and said: "Stand up with your hatchet in your hand, and use it

[16] *Documents relating to the colonial history of New York, op. cit.* 7: 119.

[17] *Ibid.*

[18] Conrad Weiser wrote that he dined at an Indian town "where an old Seneka Woman reigns with great authority." *Minutes* 5: 349. Indian "Queens" were recorded for the Conestoga; also for the Choptank and Assateague on the Eastern Shore, see WILLIAM B. MARYE, *Indian towns of the southeastern part of Sussex County, Del.*, Archaeological Society of Delaware, 1940; also *The Choptank Indians, op. cit.* 2: 5. 1937.

In this connection, it is well known that women enjoyed considerable prestige among the Five Nations. Matrons controlled the succession of chiefs, and, although unskilled in war, their influence was manifest on warriors and chiefs.

[19] *Minutes* 2: 388.

[20] *Ibid.*

[21] *Minutes* 7: 79.

manfully. Your enemies have got great advantage by your Inactivity. Show them you are Men."[22]

In the relations between Delaware and Five Nations, there constantly appear references to the "man" warrior versus the woman nonwarrior and the superiority of the former. Canyase, a Mohawk chief, expressed it this way: "We, the Mohocks are *Men*; we are made so from above, but the Delawares are Women, and under our protection, and *of too low a kind to be Men.*"[23]

The Delaware chief Tedyuskung usually referred to the Five Nations as Uncles, and once said, using the singular form: "He is a *Man* and often told us he ought to see Things first and Consider what is to be done."[24]

Accompanying the concept of woman as a nonwarrior was the notion of chastisement as a form of punishment contrasted with the challenge for battle that one would extend to a warrior opponent. Scarroyady reported in 1756 what had passed at Onondaga between the Five Nations Council and two Delaware deputies. He said: "The Six Nations in their Reply expressed great Resentment at the Delawares; they threatened to shake them by the head, saying they were drunk and out of their senses, and assured them if they did not perform what they promised, they would be severely chastized."[25]

Even the white leaders became conscious of the use of the term, and in 1755 Maj. Gen. William Shirley, commander of the English forces in North America, told the Six Nations the following: "The Delaware and Shawnese have always lived under your direction. They looked upon you as their Masters, and you looked upon them as Women who wore Petticoats. They never dared to do anything of importance without your leave, for they knew if they did you would *chastise* them; yet those People now have dared to make war upon your antient Friends."[26]

The concluding reference is of the utmost significance; it appears in the documentary accounts of the intercourse between the Five Nations and Catawba, emphasizing both the concept of the warrior "man" and the recognition of emasculation as the figurative method of degrading a warrior to the status of noncombatant female. So bitter was the state of warfare that obtained between the Iroquois and Catawba that in 1744 the whites exerted every effort to bring about peace. At a treaty council held in Lancaster June 30, commissioners from Virginia and Maryland met deputies of the Six Nations, and the following account was prepared by Conrad Weiser for the records. Weiser's familiarity with Iroquois idiom and philosophy served him in good stead in interpreting the speaker.

Gachadow, the speaker addressed the whites saying, "You charge us with not acting agreable to our Peace with the Catawbas, and we will repeat truly to you what was done:

"The Governor of New York at Albany in behalf of Assaraquoa [meaning Big Knife, the name applied by the Mohawk to the Governor of Virginia] gave us several belts from the Cherickees and Catawbas and we agreed to a Peace if those Nations would send some of their Great Men to Us to confirm it face to face, and that they would Trade with us, and desired that they would appoint a time to meet at Albany for this purpose, but they never came.

"We then desired a Letter might be sent to the Catawabas and Cherikees to desire them to come and confirm the Peace. It was long before an Answer came, but we met the Cherikees and Confirmed the Peace, and sent some of Our People to take care of them untill they returned to their own country.

"*The Catawbas refused to come, and sent us word that we were but women, that they were men and double men for they had two P——s; that they would make Women of Us*, and would be always at War with us. They are a deceitful People. Our Brother Assaraquoa is deceived by them; we don't blame him for it, but we are sorry he is so deceived."[27]

So bitter, in fact, was the feeling between them that "the Catawbas had declared to the Tutulows and Cherakees that they would never sue for Peace with the Six United Nations, but that they would fight them whilst there was one of them alive, and after their death their very Bones shall fight the Six Nations."[28]

The writer submits that the citations

[22] *Minutes* 7: 297.
[23] *Minutes* 7: 297.
[24] *Minutes* 8: 200.
[25] *Minutes* 7: 71.
[26] *Minutes* 7: 22.
[27] *Minutes* 4: 721.
[28] *Minutes* 5: 473.

offered in the foregoing discussion, appended to those presented in the previous paper, constitute overwhelming evidence in support of the premises enumerated at the beginning of this essay.

The writer acknowledges the assistance of Dr. Frank G. Speck and Dr. William N. Fenton in the preparation of the manuscript of this paper but in no way commits them to the ideas herein expressed.

ETHNOLOGY.—*Notes on a Cherokee migration story.*[1] JOHN WITTHOFT, University of Michigan. (Communicated by W. N. FENTON.)

A Cherokee tradition of migration from the Ohio Valley, mentioned by Adair and Haywood,[2] would suggest a recent separation of the Cherokee from the northern Iroquois and possible identification of the Cherokee with specific archeological complexes in the Ohio area. Cherokee ethnographic data indicate, however, that Cherokee culture is essentially Southeastern, not a recent importation; available data on Cherokee archeology suggests that the Cherokee have been long resident in their present area. Cherokee culture seems to show closest relationship to Creek. Thus it would be extremely desirable to evaluate Haywood's and Adair's suggestion and gather further data relating to Cherokee traditions of tribal origin and movement, especially in view of the Delaware traditions about the Talligewi.

While engaged in field work among the Eastern Cherokee of Qualla Reservation, North Carolina, at several periods during the past two years, I attempted to gather some data relating to this question. I could find no vestiges of any such migration legend or of any consciousness of Cherokee relations to the northward. Traditional material relating to the Iroquois was sparse, and all pertained to the period of the Iroquois-Cherokee wars. The Iroquois are known as aniˀ sᵴnákᵴ (Seneca People), probably because the Seneca were the Iroquois group best known to the Cherokee. Cherokee informants who had met Iroquois were conscious of lexical cognates in the language, but had little sense of the language relationship.

The Cayuga form of the general Iroquois name for the Cherokee, as given by Deskaheh (Alex General), of Six Nations Reserve, Ontario, Canada, is wiya'tąkehoną, "people in the hollow or valley." (Compare Mohawk Oyata'ge'ronnoⁿ', Onondaga Oyata'ge'he'noⁿ', Seneca Oyada'ge'o'ñoⁿ'—"cave or burrow dwelling people," etc. J. N. B. HEWITT, *The name Cherokee and its derivation*, Amer. Anthrop., n.s., 2: 591–593. 1900.—W.N.F.)

Work with two of the older and more conservative informants, Will West Long and Mollie Sequoyah, gradually brought out the fragments of a migration tale that they had heard in their childhood. According to this tradition, the Cherokee had come into their present area from a southwestern direction. Mollie thought that there might still be Cherokee back there somewhere—perhaps in South America. The immigrating Cherokee destroyed and displaced a race of giants, called, according to Will, tcikamoká. These giants were the people who used as tips for their arrows the large projectile points found by archeologists in this area. Will recognized two basic groups of Cherokee: the original group, from which his people split off before migration, called anig'a'du·'wagi", "confederated people"; and the Cherokee who came to the East, ondᵴ'se·lagi", "they separated from the bunch." The second group preceded the first into the East, and the two divisions seem to represent the middle and Western Cherokee dialect groups.

The name tcikamoká is apparently not a Cherokee word, and is doubtless a garbled reference to the eighteenth-century Cherokee-Creek-Shawnee renegade towns on the lower Tennessee River, known as Chickamauga or Nickajack. Indians from these towns came to the Qualla area in the early

[1] Received March 17, 1947.

[2] ADAIR, JAMES, *The history of the North America Indians:* 227. London, 1775. HAYWOOD, JOHN, *Natural and aboriginal history of Tennessee:* 226. Nashville, 1823.

nineteenth century, and some Qualla Cherokee still carry Nickajack as part of a personal name (Nickajack George, for example).

When questioned about the other names, Will said that Kadu'wa" was an old name for the Cherokee and noted that the large fertile bottom at Governors Island, N. C., about 8 miles east of the present reservation, is still known as kadu'wa?hi', "place of confederated people." This bottom contains several large archeological sites. Will also noted that this word was related to gadu'gi", the name of the Cherokee mutual aid and work society. Speck and Schaeffer have done a thorough study of this society, and considered it as a survival of a basic Cherokee-Iroquois institution[3]; I should suggest that it represents the surviving structure of a Cherokee town, its political function usurped by an introduced council and constitutional government. We may note that kadu'wa' is the name by which the Cherokee were known to many of their northern neighbors, especially the Delaware, Shawnee, and other Algonkian peoples.[4]

Will's second Cherokee group name supplies us with another possible etymology for the name Cherokee, a form that requires further checking but that seems to permit analysis without distortion of the Cherokee elements. Another, and perhaps the most convincing interpretation for this name, is not Cherokee at all and would derive the name from the Creek, Celok'okálke, "people of another language" (celokálki, "Cherokees").[5] This idea has already been suggested by Swanton[6] and would indicate that the Creek name by which the Cherokee were first known to Europeans became the general name for them in the Southeast, and was soon accepted even by the Cherokee themselves; names for other tribal groups have come into existence after a similar fashion.

Quite possibly our two early references to Cherokee migration from the Ohio Valley pertain to Cherokee expeditions into that area during the Colonial Period. The recently collected tale is apparently a much abbreviated version of the Creek migration legend, and appears to be the story which motivated Sequoyah to journey into Mexico in search of a Cherokee group in the legendary homeland, to die in San Fernando, Tamaulipas, in 1843. Such an association would indicate that it is not a recent accretion to Cherokee folklore brought to Qualla Reservation by Creek stragglers drawn to a refuge area. Sequoyah's early biographer, George Foster, tells us:

> One bright morning, in the year 1840, there started out in the Arkansas Cherokee Nation, one of the most peculiar expeditions in search of knowledge that the world has ever known. First and foremost in the company we recognize our friend, Se-quo-yah. He had heard the ancient tradition, that a part of his people were in New Mexico, having been separated from them, some time before the advent of the white race, and somewhere there, he expected to find a missing link in the linguistic chain. And for this purpose, he started westward.[7]

Gabriel refers to the same tale in his account of Sequoyah's death:

> But still that strange discontent within him was not quieted. It became a yearning to achieve the unattainable. It robbed his declining years of peace. An old, half-forgotten tradition of the Cherokees told of a band which in antiquity had wandered into the distant land of Mexico and had never been heard of since. Death caught up with Sequoyah in the little Mexican settlement of the long lost Cherokees—still striving to make dreams come true.[8]

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[3] SPECK, FRANK G., and SCHAEFFER, CLAUDE E., *The Mutual-aid and volunteer company of the eastern Cherokee: as recorded in a book of minutes in the Sequoyah syllabary, compared with mutual-aid societies of the northern Iroquois.* Journ. Washington Acad. Sci. 35: 169–179. 1945.

[4] Dr. Frank G. Speck informs me that the Delaware cognate, Kadu'ha, means cold, shivering.

[5] LOUGHRIDGE, R. M., and HODGE, D. M., *Muskogee dictionary:* St. Louis, 1890. The Yuchi is tsala"ki, plural tsala"kiha (Frank G. Speck). The Cherokee equivalent is tsala'ki', plural ani'tsala'ki'.

[6] SWANTON, JOHN R., *The Indians of the Southeastern United States.* Bur. Amer. Ethnol. Bull. 137: 217. 1946. SWANTON, *in* Webb, Wm. S., *An archaeological survey of the Norris Basin, in eastern Tennessee.* Bur. Amer. Ethnol. Bull. 118: 204–205. 1938.

[7] FOSTER, GEORGE E., *Se-quo-yah:* 155. Philadelphia, 1885.

[8] GABRIEL, RALPH HENRY, *Elias Boudinot and his America:* 105. Norman, Okla., 1941.

BOTANY.—*The ecology of the wild kidney bean* Phaseolus polystachios (*L.*) *BSP.*[1]

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In view of the great value of beans as a human food crop all over the world, and the increasing interest in the genetics of the various members of the group in problems of breeding for disease resistance and insect tolerance, and increased productivity and climatic adaptation, it seems advisable to bring together all our knowledge of the wild bean of the eastern United States so far as possible.

According to Small (1913) three species of *Phaseolus* occur in the eastern United States, *P. sinuatus* Nutt., *P. smilacifolius* Pollard, and *P. polystachios* (L.) BSP. The first two species are Florida or Gulf coast species, occurring in dry pinelands and hammocks. *P. polystachios* extends from Florida northward to Canada and Minnesota and westward into Louisiana and Nebraska. I know nothing of the behaviors and relationships of *P. sinuatus* or *P. smilacifolius*, whether the cotyledons are epigean as in the case of the beans of *P. vulgaris*, or hypogean as is the behavior of *P. polystachios*, as established by Harry A. and Howard F. Allard (1940). This would be a very interesting point to consider, however, in determining the relationships of these southern species.

Following are the distinguishing botanical characters of *Phaseolus polystachios:*

A twining, finely pubescent, herbaceous perennial with tuberous root; leaves 3-foliolate, the leaflets roundish-ovate; flowers in numerous peduncled, loosely flowered racemes, 4 to 10 inches long or more, purplish-blue, small, showy, produced from midsummer till fall; style bearded lengthwise on the upper surface; keel spirally coiled; pods somewhat curved, drooping, 2.5–5.0 cm long, 5–8 mm wide; beans 4 or 5, round reniform, 3–5 mm long, dark brown, finely speckled with black; cotyledons hypogean. A plant of thickets and woodlands on the Coastal Plain and in the Piedmont area.

HABITAT RELATIONS OF PHASEOLUS POLYSTACHIOS

Phaseolus polystachios is a thicket and woodland plant in its natural habitat and can not compete with grassland or the broomsedge habitat of open fields and pastures. Even if it were adapted to such open conditions, the trampling and browsing of stock would probably lead to its ultimate extermination here, for it is a delicate climbing plant. In northeastern Virginia, I have found it scattered over the steep rocky slopes of Bull Run Mountain, but it is far from common here. In truth I have never found it common anywhere in its range. In the Bull Run area it is usually found on the warmer more protected east slopes. It is much more common on the wooded slopes of the granitic knobs of Big Cobbler, Rattlesnake, and Oventop, all outliers of the Blue Ridge Province. I have never found it on the higher ridges of the Blue Ridge or the Alleghenies.

According to Small and Carter (1913) it occurs on sandstones, shales, and schists in Lancaster County, Pa. In the Bull Run area it occurs on the drier ridges of the Cambrian quartzites, which in weathering produce a sterile, porous, sandy type of soil. I have never quite understood the restricted distribution of this plant on the Bull Run ridges and its strong predilection for the upper slopes just below the outcropping, steeply tilted sandstone ledges. This relation holds throughout the length of these north-south ridges. One ecological relationship is very pronounced, however: this bean does not tolerate anywhere heavy, wet soils or heavy shade. The soils of the upper slopes of the ridges are not only drier, thinner, and always thoroughly drained, but the character of the forest is more open here, and better illumination obtains from the fact that it is dominated by a less vigorous stand of chestnut oaks. This combination of favorable factors may be responsible for the establishment of the wild bean in this particular zone. In favorable woodland situations there is a noticeable tendency for the plants to occur in colonies. This is due to the fact that when a perennial rootstock has become established the seeds produced tend to fall near the parent plant, and the germination of these year after year favors the development of colonies.

[1] Received April 14, 1947.

These colonies gradually enlarge as the seeds from the twining, scrambling aerial stems of the peripheral plants reach more outlying areas.

Although in Gray's *Manual* (1908) the characterization of the genus *Phaseolus* states that the fleshy cotyledons rise out of the ground nearly unchanged in germination, L. H. Bailey (1935, p. 458) says that the bean differs from the pea in being epigeal in germination that is pushing the cotyledons above the ground. I have found that this is not true for the wild kidney bean. As previously stated the cotyledons have an hypogean existence, as in the case of the cultivated Scarlet Runner bean *Phaseolus multiflorus* Willd.

Under favorable woodland conditions where there is an abundant, protective, loose, forest litter and a layer of rich leaf mold, the wild bean becomes perennial, and develops a large, tough rootstock very deeply rooted in the loose, porous soil. This rootstock may become an inch or more in diameter at the crown and produces here many buds at the leaf-mold level. Some of these rootstocks appear to have survived for many years, and thick fleshy roots have penetrated the soil for 15 to 18 inches. The wild bean grows vigorously in well-drained garden soil, but owing to the wet, soggy condition of such soil in winter, the rootstocks do not well survive the winter here.

The wild bean is a tuber-producing plant, storing up an abundance of reserve material in good-sized spindle-shaped tubers, only a portion of which is used in the annual formation of the slender aerial stems. I did not realize that tuber formation was such a pronounced characteristic of this species until I had occasion to dig up some rootstocks in the spring of 1947 in the Bull Run Mountain area. In this respect, as in the hypogean behavior of the cotyledons, the wild bean shows closer affinities with the Scarlet Runner assemblage, *Phaseolus multiflorus*, than with the common field and snap beans *Phaseolus vulgaris* L.

LENGTH-OF-DAY BEHAVIOR

I have studied the length-of-day behavior of the wild bean rather fully, both in localization experiments and on various lengths of day (Allard, 1938). In the localization tests one stem of a rootstock was kept under short-day conditions of 10 hours (from 6:00 A.M. to 4:00 P.M.) each day, while another stem from the same plant was exposed to the full day of Washington, D. C. The average length of day from March 21 to September 21, through the longest days of the summer solstice (near 15 hours from sunrise to sunset), is about 13 hours, and from April 15 to September 2 the length of day exceeds 13 hours. The stem given only 10 hours of light each day grew but little beyond the original height, 5 inches, when the tests began, and finally died late in summer without budding. The outside stem experiencing the full day grew very vigorously as a climber, attaining a height of 3–4 feet; buds appeared on July 21 and flowers August 2. This portion of the plant was very floriferous and produced many pods (Allard, 1938a, fig. 2).

Further photoperiodic studies were made subjecting the entire plant to constant lengths of day with a series of lengths of day arranged as follows: 10, 12, 12½, 13, 13½, 14, 14½ hours, and full day. These tests demonstrated that flowering was most prolific on intermediate lengths of day from 13½ hours through 14 hours, 14½ hours, and the full length of day.

Plants receiving only 10 hours of daylight each day never flowered. One flower only appeared on the plants afforded 12 hours of daylight. Flowering was more vigorous with 13 hours of daylight each day, but some of the blossoms even here were cleistogamous.

The twining habit did not develop until the plants were afforded 13½ hours of daylight but remained low, bushy, and dark green. On lengths of day shorter than 12½ hours the plants showed the dwarfed, sterile, winter behavior, with thickish, dark-green, rugose leaves and short thickened stems. These plants barely survived the summer and remained practically in a state of vegetative dormancy for many months.

The normal twining habit of the wild bean is entirely dependent upon length of day, and this response does not become evident until a length of day between 13½

and 14 hours is experienced. Until a vigorous twining habit has developed the plants produce few flowers. Vigorous flowering is not strictly correlated with the twining habit, however, since an excessively long day of 16-18 hours, obtained by artificial light, again tends to inhibit flowering, although a vigorous twining behavior is maintained. These relations are clearly shown by Allard (1938a, fig. 5). In figure 6 (Allard, 1938a) the growth of plants is shown under 12 hours and 12½ hours of light daily. The 12-hour plants never flowered, but one plant of the 12½-hour group flowered on July 27. The plants in both groups were low and bushy, with the exception of one plant experiencing 12½ hours of light daily, which produced a short runner. As a matter of fact the plants were exceptionally bushy in habit of growth under these shorter-day lengths. The pods and seeds on the 12½ hour plants were exceptionally large for the species, however, some of the pods measuring 5.8 cm in length from the tip of the beak to the calyx, with a maximum width of 11 mm.

It is evident that the wild bean is a long-day type of plant, i.e., it flowers on a lengthening day. Lengths of day below 12½ hours not only inhibit twining, so that the plants become low and bushy, but also prevent flowering. Such plants behave as if they were in a more or less quiescent or dormant condition. This short-day behavior limiting flowering and seed production would exclude this bean from the Tropics and adapt it to more northern latitudes, until cold and perhaps excessively long days became the limiting factors governing its survival.

This bean is probably a northern derivative of the more southern bean assemblage, for in its present form it could not have originated in the Tropics, nor could it survive there with its present characteristics of behavior.

Stem elongation or twining behavior is an interesting growth response in relation to length of day, and whether induced by long or by short photoperiods, depends entirely upon the species. The wild bean *P. polystachios* becomes bushy as the days are shortened. The Jack bean, *Canavalia ensiformis* (L.)DC., becomes a pronounced twiner on the same short days that produce dwarfed plants in the wild bean. The wild bean becomes a climber on an increasing length of day, while the Jack bean becomes bushy on a lengthening day. The common garden beans, *P. vulgaris*, and *Stizolobium deeringianum* Bort., as in the case of the wild bean, completely reverse these length-of-day relations of *Canavalia*, but greenness of the leaves is not noticeably changed. (Allard and Zaumeyer, 1944.)

Allard and Garner (1940) have shown that the Medellin bean, F. P. I. No. 46145 *Phaseolus coccineus* L. (*P. multiflorus*), flowered best on short days, with a remarkable enlargment of roots to produce tubers when the plants experienced photoperiods of 10 hours. This flowering behavior shows that this particular bean is eminently adapted to the short tropical days.

Some strains and varieties of tropical beans are not only short-day plants in their flowering responses but show marked tendencies to produce pronounced underground tubers under short-day conditions. This behavior was shown in the case of a tropical South American bean (*Phaseolus multiflorus*). Plants exposed to 10 hours of daylight throughout the summer, and to the shorter winter days in the warm greenhouse, became strongly tuberized (Garner and Allard, 1923, p. 893, pl. 6). Other plants of this bean exposed to the full day of summer, and to electric light during the winter in the greenhouse to extend the length of the natural day, never flowered and never produced tubers. Twelve hours of light in summer and the natural winter length of day produced less tendency to tuberize than the 10-hour plants. Tuberization of these tropical beans appears to be a response to the short days, just as in the case of the wild bean. In the latter, tuberization appears to take place on the shortening days of late summer and autumn.

CHROMOSOME NUMBER OF PHASEOLUS POLYSTACHIOS

Eleven species of beans of the genus *Phaseolus* are known to be more or less generally grown in various parts of the world. As reported by J. Kamakami (1930), all these have 22 chromosomes as the $2n$

number. Among these are *Phaseolus acutifolius, P. angularis, P. aureus, P. coccineus, P. lunatus,* and *P. mungo. Dolichos lablab* has 22 (*2n*) chromosomes.

The chromosome number of the wild bean was determined by Howard F. Allard (1940), and the *n* number of the pollen mother cells was found to be 11; the somatic (*2n*) number, then, is 22, as in all other species of *Phaseolus* reported upon. These chromosomes are of small size in the wild bean. It would appear that from the constancy of chromosome number in the genus *Phaseolus*, the genus is rather stable in this respect, or perhaps of more recent evolution. The genus as a whole appears to be of tropical and warm climate origin, since the center of distribution is within the Tropics. Such species and varieties as are now grown in higher extratropical latitudes are either day-neutral sorts or those with high critical limitations with respect to length of day which favors flowering in high latitudes.

ENEMIES

The wild bean may flower profusely, but often very few pods are found on the flowering panicles. In the green state a tiny native weevil rather freely parasitizes the pods. In my garden it seemed to me that the Mexican bean beetles were less inclined to attack this bean, but much more study is needed to establish this relationship fully.

As a food plant the beans are too small to be of any value to human beings, and there is no evidence that even the eastern Indians ever made use of this bean, owing to its scarcity. The weight of 100 mature beans harvested in the Bull Run Mountain area was only 6.8 grams.

I am informed by Dr. Volney H. Jones, of the Museum of Anthropology of the University of Michigan, that beans of some race of this species have been found fairly numerous in bluff shelters in the Ozark region of northwestern Arkansas and southern Missouri, and were apparently used for food by the early aborigines. These beans appear to be a larger-seeded race than those of our eastern assemblage, according to Dr. Jones.

It would appear that out wild bean is a plant of considerable interest in many respects—in its various photoperiodic responses, in its taxonomic relationships, and in the possibilities of useful genetic combinations in crosses with some of our useful varieties and species of cultivated beans.

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ENTOMOLOGY.—*New eumolpid beetles from the West Indies.*[1]

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Described herein are three new species of beetles of the genus *Metachroma* Dejean (Coleoptera: Eumolpidae) from Puerto Rico that have come to light in the collection of Stuart T. Danforth recently acquired by the Museum of Comparative Zoology; three new species of *Metachroma* collected by P. J. Darlington in Oriente Province, Cuba; and two new species of *Alethaxius* Lefèvre, one from Isle Tortue off Haiti, collected by Mr. and Mrs. E. C. Leonard, and the other collected by J. Acuña at Moa, Oriente Province, Cuba.

Metachroma ensiforme, n. sp.
Fig. 1

About 3 mm in length, oblong-oval, shining pale yellow with reddish-brown markings on thorax and elytra; thorax finely and densely punctate except on the sides; elytra with only vestiges of striate punctation except for the strong punctures below the basal callosity and in the intrahumeral sulcus. Aedeagus unusually long and slender.

Head with interocular space less than half its width. Occiput and vertex with a faint obsolete punctation tending to give a wrinkled appearance; a deep groove about base of antennal sockets and connecting across lower front. Antennae pale with the outer joints slightly deeper in color and thicker, extending below the humeri. Prothorax not twice as broad as long, with arcuate sides and a small acute tooth at each corner; an indented line running along basal margin and behind the eyes anteriorly; a slight depression over the head; surface thickly punctate except about the edges; yellowish brown with a deeper reddish-brown median area. Elytron with deep intrahumeral sulcus and an indented line across the base and down along the suture; punctation indistinct except in intrahumeral sulcus and below the basal callosity; yellow-brown with two short reddish-brown vittae extending over the basal callosity and a diagonal stripe from about the middle of the side down to the suture, forming on the combined elytra a wide open V; in poorly marked specimens only traces of these markings. Body beneath and legs pale yellow brown, shining, femora not toothed, claws with a long basal tooth. Length 2.7–3.1 mm; width 1.4–1.6 mm.

Type male and 4 paratypes, M. C. Z. no. 27677; 2 paratypes, U.S.N.M. no. 58356.

Type locality.—Pico Turquino, south side, 1,000–5,000 feet elevation, Oriente Province, Cuba, collected in June 1936 by P. J. Darlington.

Remarks.—The long, sword-shaped (although curved) aedeagus is unlike any that I have seen in this or related groups.

Metachroma imitans, n. sp.
Fig. 2

Length approximately 2.5 mm, ovate, shining deep reddish brown with paler legs and antennae; head and prothorax distinctly punctate; elytral punctation not very distinct over basal callosities and in apical half.

Head with interocular space nearly half as wide as head; shining and lightly punctate above, more coarsely and densely so between the eyes and in lower half; frontal tubercles indistinctly marked; no groove between the eyes. Labrum paler but jaws edged with deep brown. Antennae pale; second joint nearly twice as long as third; distal joints a little thicker and deeper in coloring; extending well below the humeri. Prothorax not twice as wide as long, with arcuate sides and a small acute tooth at each corner and an indented line along base and extending from the sides up behind the eyes on the anterior margin; surface shining deep reddish brown but not quite so dark over the head and moderately closely and distinctly punctate; a slight depression behind the head. Elytra very shiny deep brown; humeri well marked; a depression behind the basal callosity; an indented line of punctures along basal margin and down along the suture to the apex, otherwise lines of punctures not very distinct their entire length, nearly vanishing over the basal callosities and behind the middle; the punctures large in the intrahumeral sulcus and in depression below the basal callosities. Body beneath and legs paler, shining; femora without toothing; claws toothed. Length 2.3–2.5 mm; width 1.2 mm.

[1] Received March 21, 1947.

Type male and 1 paratype (female), M. C. Z. no. 27678.

Type locality.—Aguadores, Oriente Province, Cuba, collected June 6, 1936, by P. J. Darlington.

Remarks.—This is very close to a species in the National Museum collected at Cayamas, Santa Clara Province, Cuba, by E. A. Schwarz and labeled by him as *M. puncticollis* Suffrian, a name later changed in the Junk Catalogue to *M. cubaecola* Clavareau. The punctation is not quite so dense or distinct on the thorax and is less marked on the elytra. The aedeagus of the Cayamas species is peculiar in being forked like a claw at the tip, in this respect resembling at least one other species of *Metachroma* from North America. The aedeagus of *M. imitans*, in contrast, is of the ordinary sort, broad with an acute tip.

Metachroma metrium, n. sp.
Fig. 3

About 4 mm in length, broadly oblong-oval shining yellow-brown with dark markings on the occiput, thorax, and elytra; on each elytron a spot on the basal callosity, three placed transversely below the basal callosity and two or three paler ones slightly below the middle of the elytron, one on the edge and the other on the side; punctation of elytra indistinct in apical half.

Head with interocular space not half width of head; eyes large; occiput and front obsoletely punctate and somewhat wrinkled, yellowish with a broad dark band extending down front, faint indication of frontal tubercles and a slight depression between the eyes. Antennae extending to the middle of the elytra, the six distal joints deeper in color and thicker. Prothorax not quite twice as broad as long, with an acute tooth at each corner and slightly arcuate sides; surface mirror smooth, impunctate, yellow-brown with dark brown or piceous irregular markings on each side. Elytra with small humeri, a short intrahumeral depression, and not pronounced basal callosities; striate punctation rather fine except below the basal callosities and indistinct in apical half; shining yellow-brown with a dark streak in the middle of the base, three small spots across below this, the outer one on the edge, and two or three larger, less distinct spots, slightly below the middle. Body beneath and legs pale, the femora with a darker spot at the apical constriction and darker along the sides of the tibiae. No indication of toothing on femora; a short basal tooth on claws. Length 4.1–4.3 mm; width 2.2–2.4 mm.

Type male and 1 paratype, M. C. Z. no. 27679; 1 paratype, U.S.N.M. no. 58358.

Type locality.—Villalba, Puerto Rico, collected June 21–28, 1934, by C. M. Matos (Stuart T. Danforth Collection).

Remarks.—In shape and markings this species resembles somewhat *M. cinctipes* Blake, from the Dominican Republic, but that species has a larger prothorax and the elytral punctation is more distinct.

Metachroma xanthacrum, n. sp.
Fig. 4

Length 4.5 mm, oblong-oval, shining piceous with antennae, legs, margin and apex of elytra, and apex of abdomen pale; head and prothorax very finely and sparsely punctate; elytra with only the sutural striae entire, the short rows of punctures below basal callosity becoming progressively shorter toward the sides.

Head with interocular space less than half its width; eyes large; occiput and front with obsolete punctation producing a wrinkled appearance; frontal tubercles faintly outlined; no groove between the eyes, lower front deep reddish brown, also a pale spot near eye on vertex. Antennae pale, extending below humeri; second joint longer than third; five distal joints thicker and hairier than basal joints. Prothorax not twice as wide as long, with rounded sides; a tooth at each corner and an indented line along basal margin and behind the eyes anteriorly; surface very smooth and shining, a few indistinct scattered punctures; piceous except a light reddish-brown area along anterior margin. Elytra with small humeri and a basal callosity with a depression below, in which there are short rows of coarse punctures; the sutural striae alone reaching apex and the other striae becoming progressively shorter toward the side; dark piceous except along pale sides and broadly pale apex; two reddish spots on each side of scutellum at base. Body beneath deep reddish brown with paler apical segments of abdomen; legs pale except at the constriction near the apex of femora and along sides of tibiae at base. All femora weakly toothed; claws with long basal tooth. Length 4.5 mm; width 2.4 mm.

Type female, M. C. Z. no. 27680.

Type locality.—Loma del Gato, Cobre Range, Oriente Province, Cuba, at about 3,000 feet elevation; collected July 3–7, 1936, by P. J. Darlington.

Remarks.—This species lies between *M. adustum* Suffrian from Cuba and *M. wolcotti* Bryant from Haiti. It resembles the former in general coloration, having a pale apex to the elytra, but lacks the distinct elytral punctation in which the rows of punctures are entire. In this respect it resembles the Haitian species *M. wolcotti*, which is entirely dark, with dark legs and elytra. *M. terminale*, described by Horn from Florida, is identical in outward appearance with *M. adustum* and was considered the same by E. A. Schwarz, and I synonymized the two at an earlier date. Dissection shows a slight difference in the aedeagus. Whether this indicates specific differentiation is a question only to be decided by breeding. The aedeagus of *M. wolcotti* is very similar to these two and drawings are here given of all three (Fig. 8). Unfortunately the only specimen known of *M. xanthacrum* is a female. These species are all very closely related and show the effects of isolation in the development of their small differences.

Metachroma fenestratum, n. sp.
Fig. 5

About 3 mm in length, oblong, lustrous yellowish or reddish brown with a dark vitta on each side of the thorax and a broad dark marking on the basal callosity of the elytron and below along the suture, and a fainter band running from about the middle of the side diagonally across to the suture; head and thorax indistinctly punctate; elytra with large striate punctures for a short distance below the basal callosities and in the intrahumeral sulci.

Head with interocular space about half its width, smooth, in some specimens indistinct wrinkles as of obsolete punctures, the groove between the eyes and about antennal sockets deep. Antennae extending to the middle of the elytra; second joint longer than third and five distal joints heavier and with dark apex. Prothorax rather narrow, considerably less than twice as broad as long, with curved sides and a sharp tooth at each corner; an indented line along basal margin and anteriorly behind the eyes; surface very shiny, only indistinctly and sparsely punctured; deep reddish brown with a dark stripe on either side. Elytra with small humeri and basal callosities and a deep intrahumeral sulcus; a line of indented punctures along base and down suture, and short rows of large punctures below the basal callosities and in the intrahumeral grooves, these rows becoming indistinct before the middle; surface very smooth and shiny; pale yellowish brown with dark markings in the middle of the base and below for a short distance along the suture, a darker band starting from the side at the middle and extending diagonally across to the suture, but becoming paler. Body beneath shining yellowish or reddish brown. Femora not toothed; claws with a long basal tooth. Length 2.8–3 mm, width 1.4 mm.

Type male and 1 paratype, M. C. Z. no. 27681; 1 paratype, U.S.N.M. no. 58357.

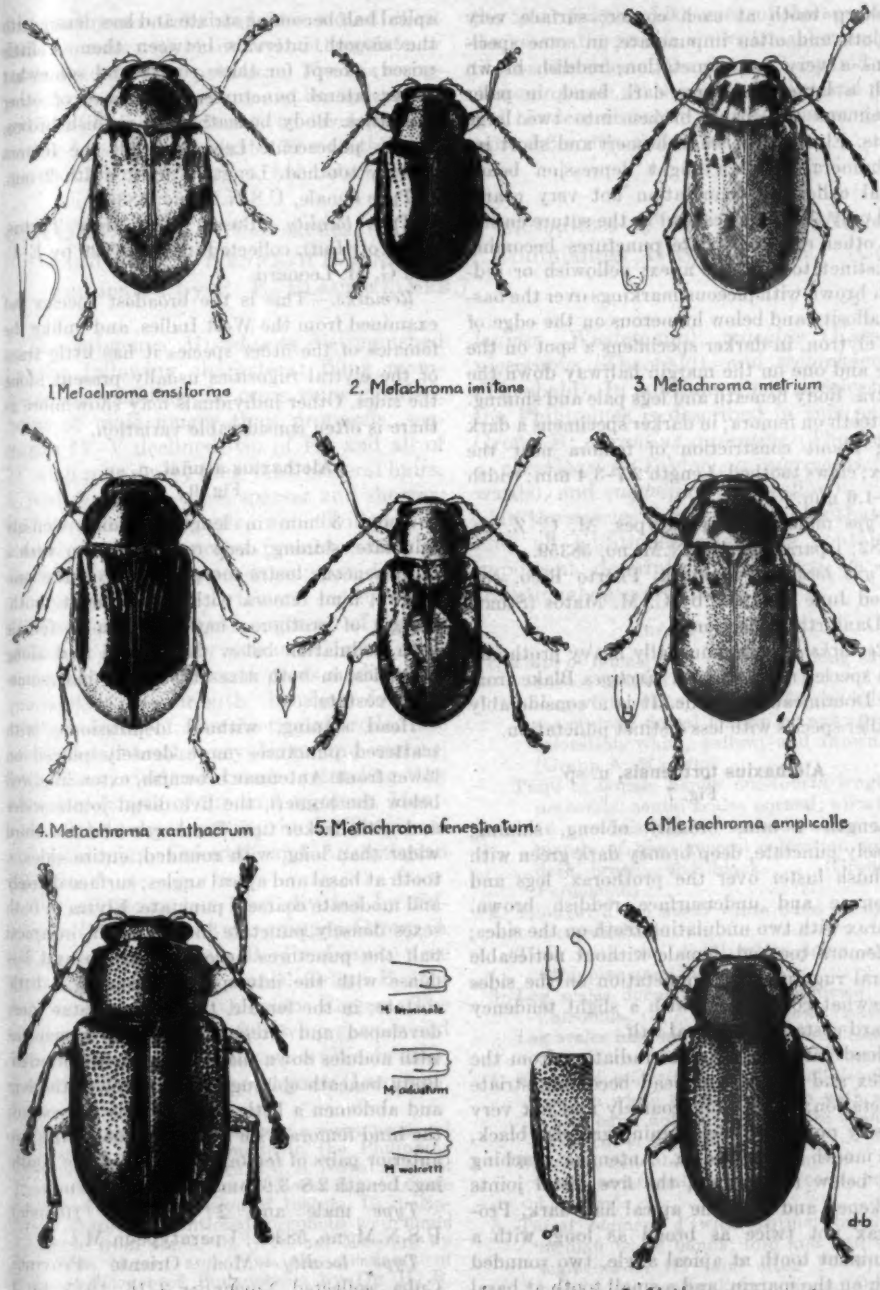
Type locality.—Yauco, Puerto Rico, collected June 15, 1934, by C. M. Matos (Stuart T. Danforth Collection).

Remarks.—This is an unusually narrow species with markings similar to *Metachroma ensiforme*. The aedeagus, though not so narrow and sword-shaped, has a long acute tip but is much broader and shorter behind the tip.

Metachroma amplicolle, n. sp.
Fig. 6

About 3 mm in length, oblong, shining, yellow or reddish brown with a dark spot on the occiput, a broad irregular band across pronotum, and a small spot at base of the basal callosity and below in the depression and on the edge, and in some specimens two spots at the middle, one on the side and the other on the edge; pronotum almost impunctate; elytra with striate punctation entire only in the two rows next to the suture. Thorax almost as broad as elytra.

Head with interocular space less than half its width; eyes large; occiput and front distinctly but finely punctate, more coarsely in lower front; a median line between the tubercles and a groove about antennal sockets, a slight depression between the eyes; yellow-brown with a broad dark band down front. Antennae pale, extending to the middle of the elytra, the five distal joints heavier. Prothorax large and about as wide as elytra, not twice as broad as long, the sides arcuate; an indented line across the base and almost across the anterior margin,



FIGS. 1–9.—New species of West Indian eumolpid beetles

a sharp tooth at each corner; surface very smooth and often impunctate, in some specimens a very fine punctation; reddish brown with a large transverse dark band, in paler specimens this band broken into two large spots. Elytra with small humeri and short intrahumeral sulci, a slight depression below basal callosities; punctation not very coarse and only the two lines next to the suture entire, the other rows of striate punctures becoming indistinct toward the apex; yellowish or reddish brown with piceous markings over the basal callosity and below humerous on the edge of the elytron, in darker specimens a spot on the side and one on the margin halfway down the elytra. Body beneath and legs pale and shining. No teeth on femora; in darker specimens a dark ring about constriction of femora near the apex; claws toothed. Length 2.7–3.4 mm; width 1.4–1.6 mm.

Type male and 3 paratypes, M. C. Z. no. 27682; 1 paratype, U.S.N.M. no. 58359.

Type locality.—Guanica, Puerto Rico, collected June 25, 1934, by C. M. Matos (Stuart T. Danforth Collection).

Remarks.—In its unusually heavy prothorax this species resembles *M. cinctipes* Blake from the Dominican Republic. It is a considerably smaller species with less distinct punctation.

Alethaxius tortuensis, n. sp.
Fig. 7

Length 4 mm, broadly oblong, shining, densely punctate, deep bronzy dark green with a bluish luster over the prothorax; legs and antennae and undersurface reddish brown. Thorax with two undulating teeth on the sides; all femora toothed; female without noticeable elytral rugosities, the punctation on the sides somewhat coarser and with a slight tendency toward costation in apical half.

Head with fine wrinkles radiating from the vertex and on back of head becoming striate punctation; lower front coarsely and not very densely punctate; deep shining greenish black, the mouth parts brown. Antennae reaching well below the humeri, the five distal joints thickened and with the apical half dark. Prothorax not twice as broad as long, with a prominent tooth at apical angle, two rounded teeth on the margin, and a small tooth at basal angle; basal margin sinuate; surface shining, densely punctate in basal half, the punctures in apical half becoming striate and less dense, with the smooth intervals between them a little raised; except for these costae and somewhat larger lateral punctures, little trace of other rugosities. Body beneath deep reddish brown, lightly pubescent. Legs with all the femora sharply toothed. Length 4 mm; width 2 mm.

Type female, U.S.N.M. no. 58360.

Type locality.—Bassin Bleu, Isle Tortue, north of Haiti, collected in April 1929 by E. C. and G. M. Leonard.

Remarks.—This is the broadest species yet examined from the West Indies, and unlike the females of the other species it has little trace of the elytral rugosities usually present along the sides. Other individuals may show more as there is often considerable variation.

Alethaxius acuñai, n. sp.
Fig. 9

About 3 mm in length, oblong, densely punctate, shining, deep reddish brown with a faint aeneous lustre more marked on the prothorax; hind femora with a prominent tooth; margin of prothorax entire; elytra in female with nodulation below the humeri and along the sides, in both sexes the apical half somewhat costate.

Head shining, without depressions, with scattered punctures more densely placed on lower front. Antennae brownish, extending well below the humeri, the five distal joints wider and with darker tips. Prothorax about a third wider than long, with rounded, entire sides, a tooth at basal and apical angles; surface densely and moderate coarsely punctate. Elytra in both sexes densely punctate in basal half, in apical half the punctures becoming striate and less dense with the interspaces becoming a little costate; in the female, the lateral costae more developed and irregular, in some specimens with nodules down the sides below the humeri. Body beneath shining reddish brown, the legs and abdomen a little paler, lightly pubescent; the hind femora with a distinct tooth, the two anterior pairs of femora with vestiges of toothing. Length 2.8–3.6 mm; width 1.4–1.7 mm.

Type male and 2 paratypes (female), U.S.N.M. no. 58361; 1 paratype in M.C.Z.

Type locality.—Moa, Oriente Province, Cuba, collected November 3–16, 1945, by J. Acuña.

Remarks.—This is the second species to be

described from Cuba and the second West Indian species with entire and not angulate or toothed sides to the prothorax. There is a suggestion of angularity in some of the specimens, and it is possible that it may be developed still further in some individuals. The toothing on the hind femora is distinct, but only faint on the other femora. Like most of the species of the genus, the female shows irregular nodulation on the sides of the elytra. Compared with *A. turquinensis*, *A. acuñai* is smaller and paler and has less distinctly toothed femora and a quite differently shaped aedeagus.

ENTOMOLOGY.—*The* Aedes (Mucidus) *mosquitoes of the Pacific* (*Diptera: Culicidae*).[1]

KENNETH L. KNIGHT, Lt. Commander, H(S), U.S.N.R. (Communicated by R. E. BLACKWELDER.)

The subgenus *Mucidus* is distinguished by the following characters: Wing membrane surrounding the cross veins clouded; palpi of male longer than proboscis, segments IV–V declined, tip of III and all of IV with many very long ventrolateral hairs, V with hairs but these sparser and shorter; male mesosome simple, not divided into lateral plates; claspettes present, with distinct articulated appendages; *ppn* bristles numerous (10–30); lower mesepimeral bristles present; eighth segment of female abdomen completely retractile, cerci long and narrow; larval mouth parts modified for predacity, the mouth brushes forming matted tufts of serrate-tipped rods, the mandibular teeth very large and strong; and larval ventral brush extending the complete length of the anal segment. Members of the subgenus occur in the Tropics of the Ethiopian, Oriental, and Australasian Regions.

The subgenus has been divided by Edwards (1932) into two groups: Group A (*Mucidus*) and Group B (*Pardomyia*) (see keys for separation points). Group B does not occur in the Ethiopian Region. The subgenus contains the following species and subspecies: Group A: *alternans* (Westwood), *grahami* (Theobald), *kermorganti* (Laveran), *laniger* (Wiedemann), *mucidus* (Karsch), *nigerrimus* (Theobald), and *scatophagoides* (Theobald). In addition, a new species from the Philippines is described in this paper. Group B: *aurantius aurantius* (Theobald), *a. chrysogaster* (Taylor), *a. nigrescens* (Edwards), and *quadripunctis* (Ludlow).

In the species' synonymic tables that follow, all additional references containing important descriptive, biological, or distributional data are cited.

KEY TO ADULTS

1. Palpi of female over one-half as long as proboscis; scutum with twisted tufts of erect long white scales; about 20–30 *ppn* bristles, some along dorsal margin of *ppn;* general coloration white, yellow, and brown. . . . (Group A. *Mucidus*) 2

   Palpi of female barely one-fourth length of proboscis; scutal scales normal; about 10–16 *ppn* bristles, few or none along dorsal margin of *ppn;* general coloration golden, dark brown, and black . . . . . (Group B. *Pardomyia*) 9

2. Tibia with the distal white band subapical; Australasian 3

   Tibia with the distal white band apical; Ethiopian and Oriental 4

3. Leg scales decumbent and appressed; New Caledonia . . . . . *kermorganti* (Laveran)

   Leg scales long and erected; Australasian . . . . . *alternans* (Westwood)

4. Fore and mid tibiae with a well-developed median white band (fore tibia with apical white band not occupying more than 0.25 of length of segment) 5

   Fore and mid tibiae without a median white band (occasionally a few pale scales present however) 6

5. Tarsal segment I with distinct basal and median white bands; fore and mid tarsal segments II–III (and often IV–V) with basal white bands; Ethiopian and Oriental . . . . . *scatophagoides* (Theobald)

   Tarsal segment I with only a narrow basal

[1] This is the seventh paper of a series prepared in part on collections made in the Philippine Islands under the auspices of U. S. Naval Medical Research Unit No. 2. The work was done in space furnished by the Division of Insects, U. S. National Museum. Additional specimens were made available from the U. S. National Museum by Dr. Alan Stone, and from the Academy of Natural Science of Philadelphia by Dr. H. R. Roberts. N. D. Riley and H. Oldroyd made it possible to examine types in the British Museum.

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white band; tarsal segments II–V unbanded; Philippines.....*ferinus*, n. sp.

6. Second hind tarsal segment brown, sometimes a few scattered white scales along its length (hind tarsal segments III–V all white except narrowly at apex); Oriental .....*laniger* (Wiedemann)

Second hind tarsal segment with at least a distinct basal white band; Ethiopian....7

7. Second and third hind tarsal segments only rather narrowly white at base; costa largely yellow.....*mucidus* (Karsch)[2]

Third hind tarsal segment white except at tip; costa dark.....8

8. Second hind tarsal segment less than half white.....*nigerrimus* (Theobald)

Second hind tarsal segment all white except at tip.....*grahami* (Theobald)

9. Scutum entirely golden scaled (may be a few dark scales scattered about); Philippines.. .....*quadripunctis* (Ludlow)

Scutum with considerable areas of dark scaling.....10

10. Scutum with a moderately broad median transverse band of golden scales extending right across the scutum, reaching this but not passing it is a broad stripe of golden scales; Australia[3].....
.....*aurantius chrysogaster* (Taylor)

Scutum not marked as described above...11

11. Terminal abdominal tergites (V–VIII) broadly yellow; Australasian and Oriental .....*a. aurantius* (Theobald)

Terminal abdominal tergites with yellow scaling largely confined to mediodorsal area (this is not so true of the males, which are not readily separable from *a. aurantius*); Solomon Islands..*a. nigrescens* (Edwards)

KEY TO LARVAE[4]

1. Siphon hair tuft attached between the two distal pecten teeth (Fig. 5), which are more widely spaced, occasionally inserted just beyond apical pecten tooth; (siphon hair tuft inserted beyond middle).... (Group B. *Pardomyia*).....2

Siphon hair tuft inserted distinctly beyond last pecten tooth (Fig. 4).... (Group A. *Mucidus*).....3

2. Siphon hair tuft with about 6 branches; comb patch consisting of about 20–26 scales; pentad hair 2 single; Oriental and Australasian..*aurantius aurantius* (Theobald)

Siphon hair tuft with 11–15 prominently plumose hairs (Fig. 5); comb patch consisting of about 50–65 scales; pentad hair 2 double; Philippines.....
.....*quadripunctis* (Ludlow)
Solomon Islands...*a. nigrescens* (Edwards)

3. Pecten teeth with 2–5 ventral denticles (head hair 5 extending forward well beyond the base of 3); Australasian.....
.....*alternans* (Westwood)

Pecten teeth with 1–2 ventral denticles (Fig. 4).....4

4. Comb scales fewer than 50; Ethiopian and Oriental.....*scatophagoides* (Theobald)

Comb scales more than 50.....5

5. Siphon scarcely tapering; siphon hair tuft inserted just beyond middle; last 3 pecten teeth more widely spaced than the others and simple; African.*nigerrimus* (Theobald)

Siphon tapering at least on distal third; siphon hair tuft inserted before middle; the last pecten teeth not more widely spaced, nor simple (Fig. 4).....6

6. Pecten consisting of 25–27 teeth; African... .....*mucidus* (Karsch)

Pecten consisting of 12–16 teeth; Philippines .....*ferinus*, n. sp.

[2] This section of the key, which relates to the purely African species, has been taken from Edwards (1941, p. 110).

[3] No specimens were seen. The key character here is taken from the type description.

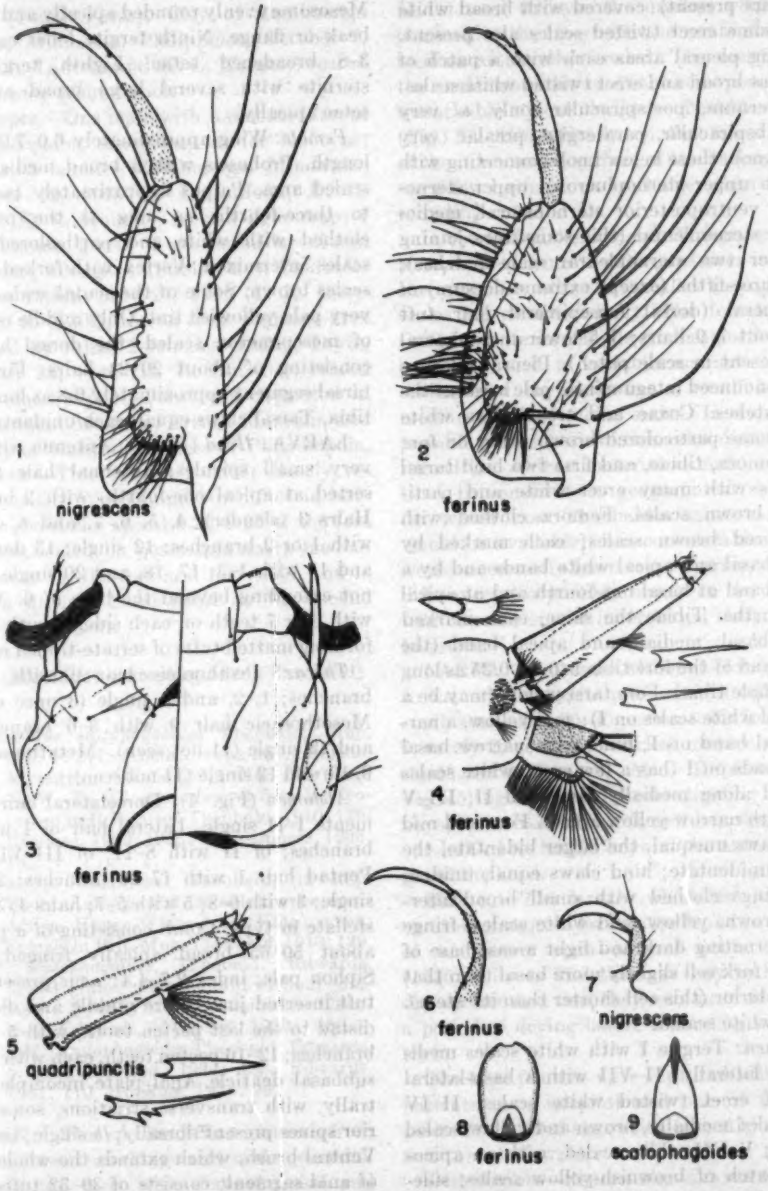
[4] The larvae of *grahami*, *kermorganti*, *laniger*, and *chrysogaster* are unknown. The larvae of *a. aurantius*, *scatophagoides*, *mucidus*, and *nigerrimus* have not been seen by me.

Aedes (Mucidus) ferinus, n. sp.

Figs. 2, 3, 4, 6, 8

ADULT. *Male.* Wing approximately 5.5 mm in length. *Head:* Proboscis largely yellow-scaled, the scales on the basal three-fifths somewhat outstanding and many of them with dark tips or particolored (particularly ventrally), an inconspicuous narrow white band just beyond middle, some white scales at apex; entire proboscis with numerous short hairs. Palpus longer than the proboscis by about the length of the last segment; clothed with yellow, white, and particolored brown scales, many of which are partially erect, segments II-V with basal white bands. Torus and first flagellar segment with broad white scales mesally. Vertex with narrow-curved white scales dorsally, these most numerous medially; elongate spatulate white scales scattered in this area; forked upright scales cream colored, scattered over posterior two-thirds of dorsum; broad white scales laterally, and along the eye margins part way to dorsal midline.

Thorax: Scutal integument grayish, marked with a lateral brown area before the scutal angle and one on the prescutellar area; clothed sparsely with narrow and narrow-curved white scales, several twisted tufts of erect long white scales present. Scutellum with many erect twisted elongate white scales on all lobes. *Apn* and *ppn* (about 24 anterior and posterior



FIGS. 1–8. *Aedes* mosquitoes of subgenus *Mucidus* (in each case the general geographical locality is given for the specimen from which the drawing was made): 1 (Guadalcanal) and 2 (Mindanao), Inner tergal aspect of basistyle of male genitalia; 3 (Mindanao), larval head, left half ventral, right half dorsal; 4 (Luzon), lateral aspects of larval terminal segments; 5 (Leyte), lateral aspects of larval siphon; 6 (Luzon) and 7 (Guadalcanal), lateral aspect of dissected claspette; 8 (Luzon) and 9 (Senegal, Africa), tergal aspect of mesosome.

dark hairs present) covered with broad white scales; some erect twisted scales also present. Following pleural areas each with a patch of mixed flat broad and erect twisted white scales: proepisternum, postspiracular (only a very few), subspiracular, paratergite, prealar (very few on knob, those below knob connecting with those on upper sternoplueron), upper sternopleural; ventroposterior sternopleural, medioanterior sternopleural (this sometimes joining the other two sternopleural scale patches); upper three-fifths (except extreme dorsum) of mesepimeral (dorsal mesepimeral hair tuft with about 7–9 hairs; 3–5 lower mesepimeral hairs present in scale patch). Pleural sclerites with pronounced integumental pale areas at the scale patches. Coxae and trochanters white scaled, some particolored brown scales on fore coxa. Femora, tibiae, and first two hind tarsal segments with many erect white and particolored brown scales. Femora clothed with particolored brown scales; each marked by narrow basal and apical white bands and by a narrow band at basal one-fourth and at apical three-fourths. Tibiae the same, each marked with a basal, median, and apical band (the apical band of the fore tibia is 0.20–0.25 as long as the whole tibia). Fore tarsi yellow (may be a few basal white scales on I); mid yellow, a narrow basal band on I; hind with narrow basal white bands on I (has a few erect white scales scattered along medially also) and II, III–V white with narrow yellow apices. Fore and mid tarsal claws unequal, the larger bidentate, the smaller unidentate; hind claws equal, unidentate. Wings clothed with small broad intermixed brown, yellow, and white scales; fringe with alternating dark and light areas; base of posterior fork cell slightly more basal than that of the anterior (this cell shorter than its stem). Halters white scaled.

Abdomen: Tergite I with white scales medially and laterally; II–VII with a baso-lateral patch of erect twisted white scales; II–IV white scaled medially, brown and yellow scaled laterally; V–VII white scaled, with an apicolateral patch of brownish-yellow scales; sidepieces white scaled basally, dark apically. Sternites II–VI brownish yellow with white basal bands, VII–VIII all white. *Genitalia* (Figs. 2, 6, 8): Inner tergal surface of basistyle with distinctive setal pattern; large basal lobe present bearing two broad spines and numerous hairs. Claspette blade rather widened medially. Mesosome evenly rounded apically and without beak or flange. Ninth tergite lobes each with 3–8 broadened setae. Eighth tergite and sternite with several large broad swordlike setae apically.

Female: Wing approximately 6.0–7.0 mm in length. Proboscis with a broad median white scaled area. Palpus approximately two-thirds to three-fourths as long as the proboscis, clothed with white and particolored brown scales intermixed. Vertex with forked upright scales brown. Some of the scutal scales have a very pale yellowish tint. Only middle one-third of mesepimeron scaled, the dorsal hair tuft consisting of about 20–24 hairs. First hind tarsal segment approximately 0.8 as long as the tibia. Tarsal claws equal, each unidentate.

LARVA. *Head* (Fig. 3): Antenna with a few very small spicules; antennal hair tuft inserted at apical one-fourth, with 2 branches. Hairs 3 (slender), 4, 5, 6, 7, and 8 single; 9 with 1 or 2 branches; 12 single; 13 double; 14 and 15 with 1–3; 17, 18, and 20 single. Hair 5 not extending beyond the base of 6. Mentum with 6 or 7 teeth on each side. Mouth brushes forming matted tufts of serrate-tipped rods.

Thorax: Prothoracic hair 0 with 5 or 6 branches; 1, 2, and 3 single (3 once double). Mesothoracic hair 9 with 3–6 branches; 10 and 12 single (11 not seen). Metathoracic hair 9, 10, and 12 single (11 not seen).

Abdomen (Fig. 4): Dorsolateral hair of segments I–II single. Lateral hair of I with 6–8 branches; of II with 8–11; of III–VI single. Pentad hair 1 with 17–20 branches; 2 and 4 single; 3 with 6–8; 5 with 5–7; hairs 1, 3, and 5 stellate in type. Comb consisting of a patch of about 50–65 broad apically fringed scales. Siphon pale; index 2.7–4.4; acus present; hair tuft inserted just before middle and distinctly distad to the last pecten tooth, with 5–7 short branches; 12–16 pecten teeth, each with a sharp subbasal denticle. Anal plate incomplete ventrally, with transverse striations, some posterior spines present dorsally; *lh* single; *isc* single. Ventral brush, which extends the whole length of anal segment, consists of 30–32 tufts, those along the posterior half arising from a barred area, each tuft with 7–9 branches. Anal gills lanceolate, with the ventral pair slightly longer than the dorsal pair and about 0.7 as long as the anal plate.

Holotype.—Male, with associated larval and pupal skins (U.S.N.M. no. 58363), San

Ramon (Penal Farm), City of Zamboanga Province, Mindanao, Philippines, October 2, 1945 (J. L. Laffoon and K. L. Knight), reared from a grassy ground pool.

Paratypes.—One male with associated larval and pupal skins, same data as for holotype; 15 males, 3 females, Zamboanga, Mindanao, September 12, 1945 (J. L. Laffoon, D. R. Johnson, K. L. Knight), from a light trap; 1 male, 1 female, 2 sets of associated larval and pupal skins, Olongapo (Subic Bay), Zambales Province, Luzon, July 21, 1945 (L. E. Rozeboom, E. S. Zolik), reared from a grassy area inundated by rains; 2 females, Dulag, Leyte, November 25, 1944 (H. R. Roberts), reared from a marshy pool. Paratypes deposited in U. S. National Museum, British Museum, and Academy of Natural Sciences of Philadelphia.

Remarks.—This species is most closely related to *laniger* Wiedemann but differs in having only about the apical 0.20–0.25 of the fore tibia white-scaled, in possessing sharp median white bands on the fore and mid tibia, and in having a distinct basal band on the second hind tarsal segment.

Aedes (Mucidus) scatophagoides (Theobald)

Fig. 9

1901. *Mucidus scataphagoides* Theobald, Mon. Cul. 1: 277 (female). TYPE-LOC.: Burma. Myingyan (Watson). India. Morabad, N.-W. P. (Close). TYPE: 2 females (cotypes) in Brit. Mus. Theobald, 1910: 126. Barraud, 1929: 1053. Christophers, 1906: 13.

1908. *Mucidus sudanensis* Theobald, 3d Rep. Wellc. Lab., p. 252 (female). TYPE-LOC.: Africa. Upper White Nile (King). TYPE: Female in Brit. Mus. Theobald, 1910: 129.

1911. *M. scatophagoides*, Theobald. Edwards, p. 246. Name emended, but without comment. Synonym of *sudanensis* Theobald. Edwards, 1911: 246; 1922a: 450.

1932. *A.* (*M.*) *scatophagoides* Theobald. Edwards, p. 135. Barraud, 1934: 138. Edwards, 1941: 110. Hopkins, 1936: 99.

ADULT. This species differs distinctly from *ferinus* in tarsal markings and male genitalia. Fore and mid tarsi with distinct basal and median white bands on I, basal white bands on II and III, segments IV and V usually all yellow but may also bear basal bands; hind tarsi with basal and median white bands on I, basal white bands on II–V, the band on II occupying about one-third of the segment, those on III–V about one-half. Abdominal tergites II–III tend to have the median white scales confined to the base with the remainder of the median area yellow-scaled. The mesosome of the male genitalia is distinct in possessing a remarkable apical flange or beaklike process (Fig. 9). Also apically on the mesal margin of the inner tergal surface of the basistyle there are a few hairs which are longer than the surrounding ones.

In the material examined, African specimens were distinct from the Oriental ones in having the proboscis all yellow-scaled (many brown scales on proximal half). The female of the Oriental material has the median portion of the proboscis with a variable amount of white scaling and the male has a small indefinite median band of white scales. It would seem possible on the basis of this color distinction to regard the African material as sufficiently distinct to constitute a geographical subspecies (in which case Theobald's name *sudanensis* would be available), but considerable material would necessarily have to be examined first. A difference also possibly occurs in the distribution of setae on the inner tergal surface of the basistyle.

LARVA. Not seen. Although closely similar to that of *ferinus*, its possession of only 30–40 comb scales and 20–30 pecten teeth (each with 1, rarely 2, ventral denticles) may constitute a significant difference. Also, Hopkins (1936, Fig. 45) figures head hair 5 extending cephalad beyond the base of hair 3, and hair 6 extending one-half of its length beyond the anterior margin of the head.

Habitat.—The larvae, which are predatory on other mosquito larvae, are found in all types of temporary open natural pools. Hopkins (1936) believes that the eggs may be laid on a dry surface and that they may need to undergo a period of drying before a flooding will batch them.

The type females were captured while biting patients in a hospital and one of them deposited separated eggs when placed in a slanted test tube over water.

Distribution.—SPECIMENS EXAMINED: U.S. N.M. (3 males, 3 females): *India* (S. R. Christophers). Amritsar (S. R. C.); Calcutta, Bengal (D. E. Hardy, G. F. Johnstone). Also 1 male and 3 females from Africa. British Museum (1 male, 1 female): *India*. Behar: Pusa (F. M. Hewlett). N. Canara: Karwar (H. Cogill).

ADDITIONAL RECORDS FROM THE LITERATURE: Throughout tropical Africa. Widely distributed in the Oriental Region from Rajputana to Burma, and through Central Provinces and Madras to Ceylon (Barraud, 1934). *China*. Kwangtung: Hongkong (Feng, 1938).

Aedes (Mucidus) laniger (Wiedemann)

1821. *Culex laniger* Wiedemann, Dipt. Exot., p. 9 (female). TYPE-LOC.: Java. TYPE: Female in Copenhagen Mus.

1901. *Mucidus laniger*. Wiedemann. Theobald, p. 269.

1908. *Mucidus mucidus*.—Theobald. Leicester, p. 69.

1913. *Mucidus laniger* (Wied.). Edwards, p. 224. Synonymy of *mucidus* Leicester, 1908. Edwards, 1922a: 451. Barraud, 1929: 1053.

1932. *A.* (*M.*) *laniger* Wiedemann. Edwards, p. 134. Barraud, 1934: 147. Bohart, 1945: 55.

ADULT. No mention is made in the literature of whether Wiedemann's type has ever been reexamined; and since no one has redescribed material from the type locality, the exact determination of *laniger* remains somewhat in doubt. This uncertainty is largely due to the incompleteness of Wiedemann's description and to the discrepancies existing between it and the material assigned to this species by various authors.

I have examined a female specimen from Deli, Sumatra, in the collection of the British Museum, which I am at present considering to be *laniger*, largely because of the nearness of its collection locality to that of the type. This specimen resembled *ferinus* except as follows: proboscis brownish yellow with a few white scales about the middle and at the extreme apex; apices of tibiae appearing more broadly banded; fore and mid tibiae with only basal and apical white bands, hind tibia also with a median band; segment I of hind tarsi with a basal white area and with some white scales scattered along the rest of the segment, II brown with a few white scales scattered over length, III and IV all white except for a narrow apical brown band, V largely white.

The only descriptive notes found in the literature on this species (in addition to the original description) are by Macquart (1838, p. 176) from a female from Coromandel (probably Madras, India); Leicester (1908, p. 69) from Kuala Lumpur, Malaya; Edwards (1913, p. 224; 1922a, p. 451); and Barraud (1934, p. 147) from Ceylon and possibly Assam material. Edwards's notes check with the specimen described above. He states that the first hind tarsal segment is nearly as long as the hind tibia, which is a character I did not check on the Sumatran specimen. Barraud's description is similar.

Leicester's specimens were examined by me in the British Museum and did not appear to differ from the Sumatran specimen. However, in his description he states that the hind tarsi have a narrow basal white band on I, with the rest all white scaled. This is probably an error due to not seeing the separation point between segments I and II. He describes the smaller fore tarsal claw and both hind claws of the male as being simple. Unfortunately I did not check this statement, but if true it constitutes a rather striking difference between *laniger* and *ferinus*.

Wiedemann has several points in his description that do not check either with the Sumatran specimen or with the descriptions mentioned above. According to Theobald's (1901, p. 269) translation, Wiedemann described the proboscis as being yellow with a white band at apex, and the hind tarsi as having white apices. These are the main discrepancies existing in his description and could both easily be errors in observation of color versus structure.

Macquart's notes on a specimen from Coromandel mention that all the tarsi have white basal bands on each segment. This seems very much as if he had a specimen of *scutophagoides*.

I have examined a female from Ceylon in the British Museum that checked with the Sumatran specimen except for the minor points of having a few median white scales on the fore and mid tibiae and having the fore and mid tarsi all dark.

In the U. S. National Museum collection there are two Philippine females of this species that check well with the Sumatran specimen. In these specimens the apical 0.31–0.33 of the fore tibia is white scaled. The specimens differ from *laniger* as described by Edwards and Barraud, however, in having the first hind tarsal segment only 0.81–0.89 as long as the hind tibia. There is also an unassociated male genitalic slide in the U.S.N.M. that is labeled "*Mucidus laniger* Wied." It is very similar to *ferinus* except that the large spines on the basal

lobe of the basistyle are noticeably slenderer.

LARVA. Undescribed.

Distribution.—SPECIMENS EXAMINED: U. S. N.M. (2 females, 1 male genitalic slide): *Philippines.* Mindanao: Ludlow Barracks, Parang; Pettit Barracks, Zamboanga (F. Visaya). British Museum (3 females, 1 male): *Malaya.* Kuala Lumpur (G. F. Leicester). *Ceylon.* Trincomali (C. F. S. Baker). *Sumatra.* Deli (A. F. Stanton).

ADDITIONAL RECORDS FROM THE LITERATURE: *Assam* (?) (Barraud, 1934). *Sumatra.* Atchin: Tjane. Djambi: Moeara Tebo. Lampong districts: Semangka Plain (Brug and Edwards, 1931). *Philippines.* Luzon: Manila (Banks, 1906). Mindoro: Calapan (Edwards, 1929).

Aedes (Mucidus) alternans (Westwood)

1835. *Culex alternans* Westwood, Ann. Soc. Ent. France 4: 681 (female). TYPE-LOC. Nova Hollandia (Australia). TYPE: Female originally in Hope Coll., Oxford; now in Brit. Mus. Westwood, 1881: 384. Skuse, 1889: 1726.

1856. *Culex commovens* Walker, Insecta Saundersiana 1: 432 (females). TYPE-LOC.: New Holland (Australia) (Saunders). TYPE: female (holotype) in Brit. Mus. (identified as type by E. A. Waterhouse).

1889. *Culex hispidosus* Skuse, Proc. Linn. Soc. New South Wales 3 (n.s.): 1726 (males, females). TYPE-LOC.: Hexham Swamp, near Newcastle and Richmond, New South Wales (Skuse); Mount Kembla, Illawarra, New South Wales (Hamilton); Breakfast Creek, Brisbane, Queensland (Tryon). TYPE: Location unknown to me.

1901. *Mucidus alternans.* Westwood. Theobald, p. 269. Synonymy of *commovens* and *hispidosus.* Hamlyn-Harris, 1933: 230. Cooling, 1924: 17. Edwards, 1924: 367; 1922a: 450. Theobald, 1903: 134; 1907: 162; 1910: 125. Felt, 1905: 473.

1932. *A.* (*M.*) *alternans* Westwood. Edwards, p. 134. Lee, 1944: 48, 50.

ADULT. Resembling *ferinus* but differing chiefly as follows: *Male.* Proboscis without a median white scaled area. Scutum white scaled, marked with distinct areas of yellow scaling. Postspiracular area with many broad white scales; all of mesepimeron scaled except ventral margin; pleuron rather uniformly brown colored. Femora with apical white scaling much reduced, sometimes even lacking on fore femur; fore femur with the subbasal white band usually absent; hind femur sometimes with whole basal one-half white. Tibiae each with basal, median, and subapical white bands. Fore and mid tarsi with basal and medium white bands on I (in Australian material, these two bands tend to coalesce), II and III with basal three-fifths white; hind tarsi with a basal and median band on I, II and III with about basal one-half white, IV and V with about basal three-fourths white. Tergites II–III largely yellow dorsally, a few median white scales; IV–VII with broad white basal areas, the white extending posteriorly on the midline. Genitalia essentially as in *ferinus* except that there are 1–2 stouter, more elongate setae apically on the inner margin of the inner tergal surface of the basistyle (figured by Felt, 1905, pl. 7).

Female. Vertex with the scales along the eye margins and on the midline white, narrow yellow scales subdorsally, broad yellow scales laterally, some broad white scales at extreme lateral margins. Scutum brownish-yellow scaled, several tufts of erect twisted white scales. Tergites largely yellow dorsally, basal white bands on V–VII, a basomedian white spot extending posteriorly on midline of IV–VII.

LARVA (1 larva, from New Caledonia). Closely similar to that of *ferinus*, but possibly differing as follows: head hairs 5 and 6 noticeably longer, 5 extending cephalad beyond the base of 3 and 6 extending about one-third of its length beyond the anterior margin of the head. (Meso- and metathoracic pleural tufts missing.) Pecten teeth 20–21 in number, most of them with 2–4 ventral denticles.

Habitat.—The predatory larva is commonly found in high-tide marshy pools, but during the seasons of low tides is often taken in inland fresh-water ground pools.

The adult is a vicious biter, even entering homes to do so, and bites mainly at sundown. It commonly migrates a considerable distance inland from the coast. The eggs are deposited singly on the water.

Remarks.—The types of *alternans* and of *commovens* have been examined by me. That of *alternans* is in such poor condition as to be almost completely unrecognizable.

The adult of this species is well distinct from either *scatophagoides*, *laniger*, or *ferinus* on the basis of the subapical white tibial band. The larva is apparently distinct in having pecten teeth with 2–4 denticles each.

Distribution.—SPECIMENS EXAMINED: U.S.

N.M. (16 males, 23 females, 1 larva): *New Caledonia.* (A. R. Gaufin); Ducas Penin. (K. L. Knight); Noumea (Dunlop): Baie Chambeyron, La Foa (Platsch and Remington). *Australia.* Queensland: Normantown and Townsville (G. F. Hill); Rockhampton and Townsville (F. H. Taylor); Burpengary (T. L. Bancroft); Eidsvold (C. F. Baker); Brisbane (Hamlyn-Harris); Cairns.

ADDITIONAL RECORDS FROM THE LITERATURE: *Australia.* Victoria. New South Wales. Northern Territory. *New Guinea.* Papua (Edwards, 1924).

Aedes (Mucidus) kermorganti (Laveran)

1901. *Culex kermorganti* Laveran, C. R. Soc. Biol. 53: 568 (2 females). TYPE-LOC.: New Caledonia. Noumea. TYPE: Female (holotype), dissected and mounted on 2 slides, Pasteur Institute, Paris.
1922. *Mucidus kermorganti* (Laveran). Edwards, 1922a, p. 99. Edwards, 1922b: 450; 1924: 367.
1932. *A.* (*M.*) *kermorganti* Laveran. Edwards, p. 134.

ADULT. Apparently indistinguishable from *alternans* except that the scales of the abdomen and legs are very small and all closely appressed.

This species is still known only from the type series. According to Edwards (1922a), there were two females (apparently the type series) of this species in the Paris Museum. Of these, one specimen, from Calama, 1869 (Delacour), was presented to the British Museum where I examined it in 1946. The other specimen, judged from Edwards's (1922a) account, should still be in the Paris Museum.

However, J. A. Reid, who kindly searched for Laveran's types for me in the collections of the Paris Museum in October 1946, was unable to find the *kermorganti* type there. But in the collections of the Pasteur Institute, Paris, along with other Laveran types, he did find a dissected, slide-mounted female of this species. This I am considering to be the type for the species.

Aedes (Mucidus) quadripunctis (Ludlow)
Fig. 5

1910. *Pardomyia quadripunctis* Ludlow, in Theobald, Mon. Cul. 5: 608 (female). TYPE-LOC.: Philippines. Parang. Mindanao. TYPE: female (holotype) in U.S.N.M. Edwards, 1922b: 451.
1932. *A.* (*M.*) *aurantius* var. *quadripunctis* Ludlow. Edward, p. 135.
1945. *Aedes* (*Mucidus*) *quadripunctis* (Ludlow). Bohart, p. 55.

ADULT. *Male.* Wing approximately 4.2–4.7 mm in length. *Head:* Proboscis yellow-scaled, some black scales basally on ventral and lateral aspects, may be a few apical dark scales also. Palpus equal to proboscis in length, or somewhat longer; yellow-scaled with sparse black scales at the apices of each segment, V with the apical one-half dark. Torus orange, bare. Vertex with narrow golden scales dorsally, thickest along eye margins; brownish-yellow forked upright scales over whole dorsum; broadened yellow scales laterally.

Thorax: Scutal integument brownish gray, with areas of dark brown; sparsely clothed with narrow yellow scales (some scattered brown scales may also be present). Scutellum with narrow yellow scales on each lobe. *Apn, ppn* (about 10–13 posterior bristles) and proepisternum sparsely covered with narrow and narrow-curved yellow scales. A small patch of broadened elongate yellow scales on each of the following areas: paratergite, prealar (below the knob), upper sternopleural, ventroposterior sternopleural and middle mesepimeral. Coxae yellow-scaled, fore may also have a median patch of black scales. Trochanters with mixed dark and yellow scaling. Femora and fore and mid tibiae yellow, with a variable amount of spotted black scaling, these dark markings reduced posteriorly; hind tibia black, marked with a small basal yellow band and some yellow mottling. Fore and mid tarsi yellow, the apical half of II and all of III and IV may show a dusky sheen; hind tarsus black, I–III with narrow basal yellow bands (that on III may be absent), V completely creamy-white scaled. Fore and mid tarsal claws unequal, each with a single tooth; hind claws equal, simple. Wings with costa and vein 1 covered with very small yellow and black scales, remainder of veins with such small scales as to appear virtually unscaled; both forkcells considerably shorter than their stems, the second fork cell beginning more basally than the first. Halter pale, knob dark and pale scaled.

Abdomen: Tergites golden-scaled, usually some scattered dark scales on one or more of the segments. Sternites golden scaled, some dark scales on II–III. *Genitalia:* Apparently not dis-

tinct from that of *a. nigrescens* (see Figs. 1 and 7).

Female. Wing approximately 5.0–5.7 mm. in length. Palpus approximately one-fourth the length of the proboscis; golden, with apices dark. Torus mesally with a patch of golden scales. Tarsal claws equal, each unidentate. In general, the legs of the female have more extensive dark scaling than they do in the males. The fore and mid tarsi may be largely dark with basal pale bands on I and II. The abdominal tergites may also have more scattered black scales than described for the male.

LARVA (description based on 5 adult-associated skins from Leyte). Closely similar to that of *ferinus* but differing most noticeably as follows: Antennal hair tuft with 3–5 branches. Head hair 3 located on the line of the suture, broad basally and tapered acutely (not a normal slender hair as in *ferinus*); hair 5 extending beyond the base of hair 6 nearly to the anterior margin of head; hair 2 double. Mesothoracic hair 9 with 6 or 7 branches. Metathoracic hair 9 with 8 or 9 branches. Lateral hair of abdominal segments III–IV double; of V–VI single. Pentad hair 1 with 11–15 branches, 2 double, 5 with 9–14. Siphon hair tuft (Fig. 5) inserted just beyond the middle of the siphon and between the last two pecten teeth, the base of the tuft strongly fan-shaped, with 11–15 prominently plumose branches. Pecten teeth 17–22 in number, sharply pointed and with 2–4 ventral denticles; the last two teeth more widely separated than the others, simple or with only 1 or 2 very small denticles. Anal plate with posterior margin smooth. Ventral brush consisting of 22–26 tufts, the basal 6 or 7 not arising from the barred area, each tuft with 7–11 branches.

Habitat.—The larvae, which are obviously predacious, were collected from rain-filled temporary puddles.

Remarks.—Closely similar to *a. aurantius* (see under that species for differences). The type has been examined, and all the scutellar scales were found to be yellow instead of partly brown as described by Ludlow.

The larva has not previously been described.

Distribution.—SPECIMENS EXAMINED: Acad. Nat. Sci. Philadelphia (4 males, 5 females, 5 sets of adult-associated larval and pupal skins): *Philippines.* Leyte: Tacloban and Dulag (H. R. Roberts). U.S.N.M. (1 female): *Philippines* (R. C. McGregor).

Aedes (Mucidus) aurantius aurantius
(Theobald)

1907. *Pardomyia aurantia* Theobald, Mon. Cul. 4: 280 (female). TYPE-LOC.: Borneo. Kuching, Sarawak (Barker). TYPE: Female (holotype) in Brit. Mus.

1908. *Ekrinomyia aureostriata* Leicester, Cul. Malaya, p. 71 (males, females). TYPE-LOC.: Malaya. Klang, Kuala Lumpur (Leicester). TYPE: 3 females, 3 males (cotypes), in Brit. Mus.; 1 female (cotype) in U.S.N.M.

1913. *Pardomyia aurantia,* Theo. Edwards, p. 224. Synonymy of *aureostriata* Leicester. Edwards, 1922b: 451. Paine and Edwards, 1929: 305.

1931. *M.* (*Pardomyia*) *aurantius* Theo. Brug and Edwards, p. 257.

1932. *A.* (*M.*) *aurantius* Theobald. Edwards, p. 135.

1944. *Aedes* (*Mucidus*) *aurantius aurantius* (Theobald). Knight, Bohart, and Bohart, p. 33.

ADULT (described from Theobald's and Leicester's type material). Closely similar to *quadripunctis* but chiefly distinct in having the scutum dark scaled except for a prominent anterior transverse area of narrow yellow scales (also a few yellow scales around the prescutellar space and over the wing base).

Also: Proboscis may possess considerable black scaling. Forked upright vertex scales vary from golden to brownish in color. A few dark hairlike scales usually present on the subspiracular area along the dorsal-anterior margin of the sternopleuron. Wing fork cells nearly as long as their stems. In the female, tergites I–III are largely dark scaled; I with a narrow yellow band laterally, II–III with a divided median yellow patch, remainder of the tergites yellow except for occasional scattered dark scales. The tergites of the male marked approximately the same, except usually there are somewhat fewer dark scales. Male genitalia similar to that of *a. nigrescens* (see Figs. 1 and 7).

Leicester (1908) described the hind female claws as being simple, but actually they each have a very small tooth.

LARVA. Not seen. Described and figured however, by Edwards and Givens (1928, Singapore specimens) and by Lee (1944, specimens from Milne Bay, New Guinea). Dorsal characters of the head similar to those of *quadripunctis* except that Lee figures head hair 5 as not extending cephalad beyond the base of hair 6. Thoracic hairs not specifically described.

Dorsolateral hair of abdominal segment I single; lateral hair of I with 6 branches, of II with 10, of III–VII double. Comb patch of about 20–26 bluntly rounded and apically fringed teeth. Pentad hair (as fig. by Lee, 1944) 1 and 5 with 8 branches, 2 single. Siphon index about 2; acus well-developed; pecten composed of about 20 rather close-set teeth, each with 2–5 denticles, the line of teeth extending to just beyond the middle of siphon, the two distal teeth more widely separated than the others; siphon hair tuft with about 6 branches, inserted between the two distal pecten teeth. Anal segment as in *quadripunctis*.

PUPA. Partially figured and described by Edwards and Givens (1928).

Habitat.—The predacious larva has been reported from pig wallows, small clear marshy pools, a pot-hole in a mangrove swamp, and grass-grown pools in swamps.

Remarks.—All the type specimens of *a. aurantius* and *aureostriata* have been examined. This species is distinct in the adult from *quadripunctis* on the color of the scutal and abdominal tergal scales, and in the larva (possibly) on the length of head hair 5, on the number of comb scales, and on the number of branches of the siphon hair tuft and of pentad hair 2.

Distribution.—SPECIMENS EXAMINED: U.S. N.M. (8 males, 3 females): *New Guinea.* Papua: Gilli Gilli. Dutch New Guinea: Toem (long. 139°, lat. 1° 59′) (E. S. Ross).

ADDITIONAL RECORDS FROM THE LITERATURE: *Sumatra.* Lampong districts: Moeara Tebo. Riouw Archipel: Doerian (Brug and Edwards, 1931). *New Guinea.* Papua: Milne Bay (Lee, 1944).

Aedes (Mucidus) aurantius nigrescens (Edwards)

Figs. 1, 7

1929. *Pardomyia aurantia* var. *nigrescens* Edwards, in Paine and Edwards, Bull. Ent. Res. **20**: 314 (female, larva). TYPE-LOC.: Solomon Islands. Lady Lever Plantation, Kulambangra (Paine). TYPE: female (holotype) in Brit. Mus.

1932. *A.(M.) aurantius* var. *nigrescens* Paine and Edwards. Edwards, p. 135.

1944. *Aedes (Mucidus) aurantius nigrescens* Edwards. Knight, Bohart, and Bohart, p. 50.

ADULT. Very similar to *a. aurantius* but differing chiefly in the color of the abdominal tergite scaling. In the female, tergites II–IV black marked with a narrow basal yellow line and a median pair of yellow spots, and sometimes with a few scattered yellow scales; V–VII black, each broadly marked by a median patch of yellow scales that reaches the posterior margin of the segment. The male tergites however, are colored practically as in *a. aurantius*, except that there are rather more scattered black scales laterally on IV–VII. Male genitalia (Figs. 1 and 7) similar to that of *quadripunctis* and *a. aurantius*.

LARVA (2 larval skins from Solomon Islands). Apparently not separable from that of *quadripunctis*. In the type description, Edwards states that the larva differs from that of *a. aurantius* only in having the antenna slightly longer and the siphon distinctly longer (index about 2.7). However, the specimens in the U. S. National Museum differ from *a. aurantius* on the same characters that *quadripunctis* differs from it.

Habitat.—The predacious larva occurs in all types of rain-filled temporary puddles and pools, either in the open or in swamps or woodlands.

Remarks.—I have examined the type. As Edwards indicates, *a. nigrescens* appears to be only a geographical subspecies based essentially on female color characters. The larva is not distinct from that of *quadripunctis*.

Distribution.—SPECIMENS EXAMINED. U.S.-N.M. (5 males, 15 females, 4 sets of adult-associated larval and pupal skins, 2 larvae, 1 larval skin, 2 pupal skins): *Solomon Islands.* Guadalcanal: Lunga district (J. N. Belkin, A. B. Gurney, L. E. Rozeboom, J. L. Laffoon). New Georgia group: Banika Island (W. G. Downs). Bougainville: Torokina area (A. B. Gurney).

Aedes (Mucidus) aurantius chrysogaster (Taylor)

1927. *Mucidus chrysogaster* Taylor, Bull. Ent. Res. **18**: 67 (female). TYPE-LOC.: Australia. Berner Creek, near Innisfail, Queensland (Taylor). TYPE: 2 females (holotype and paratype), in Australian Inst. Trop. Med., Townsville, Queensland.

1944. *Aedes (Mucidus) aurantius chrysogaster* Taylor. Knight, Bohart, and Bohart, p. 50.

Since the type description, there have been no additional published notes on this species;

nor have I seen the types. However, from a careful consideration of the type description, it appears to have no significant differences from *a. nigrescens* except in scutal markings. Taylor describes the scutum as follows: "Scutum chocolate-coloured, covered with mixed golden and chocolate-brown, narrow-curved scales; there is a moderately broad median transverse band of golden scales reaching right across the scutum, reaching this but not passing it is a broad (about a quarter the width of the scutum) stripe of golden scales, the golden scales are very pronounced on the anterior margin of the scutum."

The larvae were found in a shallow rock pool containing a large quantity of decaying vegetable matter.

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ZOOLOGY.—*Observations on the occurrence of certain barnacles and isopods at Beaufort, N. C.*[1] A. S. PEARSE, Duke University.

During the summer of 1946 collections were made of certain crustacean parasites that occurred on marine mollusks, crabs, shrimps, king crabs, and fishes at Beaufort, N. C. The results for copepods have already been published (1947). The present report deals with barnacles and isopods. Thanks are due to L. B. Hayes, David Busby, and Glen E. Mathisen who helped with the routine examinations. A new isopod is described. Specimens of this and other crustaceans have been deposited in the United States National Museum.

Order CIRRIPEDIA
Division LEPADOMORPHA
Octolasmis mulleri (Coker)

Coker (1902) wrote an excellent paper on the occurrence and development of this barnacle from studies he made at Beaufort. He examined

[1] Received March 31, 1947.

180 blue crabs (*Callinectes sapidus* Rathbun) and found 128 (71 percent) infested with these parasitic barnacles. The females more often carried barnacles in their gill chambers (89 percent) than males (56 percent). The number in crabs ranged from "one to as many as can be crowded into the branchial chambers —500 to 1,000, or perhaps more." Coker also at times found the barnacles in the branchial chambers of stone crabs (*Menippe mercenaria* Stimson) and spider crabs (*Labinia caniliculata* Say).

During the summer of 1946 (June 8–28) the writer examined 93 *Callinectes sapidus* and 22 (23.7 percent) contained from 1 to 84 barnacles. These numbers are below those reported by Coker, but he says that infestation was heavier in the latter part of the summer. The writer found a total of 554 barnacles, an average of almost six per crab.

Division BALANOMORPHA

Chelonibia patula (Ranzani)

Ninety-three blue crabs (*Callinectes sapidus* Rathbun) examined during June 1946 bore 1,592 of these barnacles on the carapace, legs, and abdomen; an average of 17 per individual. Those from deeper water had more than those from shallow shores; 7 taken in a trawl at a depth of 40 feet bore 485; one individual, 120. Of the 93 hosts examined, 57 bore Chelonibias (61 percent).

Four king crabs (*Limulus polyphemus* Linnaeus), examined on June 27, bore 198 barnacles; some of these were of this species, some of *Balanus amphitrite niveus* Darwin, and some too small to be placed specifically.

Order ISOPODA

Tribe CYMOTHOIDA

Nerocila acuminata Schioedte and Meinert

On June 11 two fishes (banded croaker, *Larimus fasciatus* Holbrook; weakfish, *Cynoscion regalis* Bloch and Schneider), were found floating in the channel in front of the Duke University Marine Laboratory. Both of these had a female *Nerocila* in the mouth. On June 24 five harvestfishes, *Peprilus alepidotus* (Linnaeus), contained three more, and on June 26 three of the same fishes bore another one. On June 28 ten sea-robins, *Prionotus carolinus* (Linnaeus), had one in the mouth of one individual. On July 31 five spadefish, *Chaetodipterus faber* (Broussonet), furnished another in a branchial chamber. On August 21 a pinfish, *Lagodon rhomboides* (Linnaeus), had one in its mouth. All the hosts mentioned are spiny-rayed fishes (Acanthopteri), but Richardson (1905) reports this isopod from the sawfish, *Pristis pectinatus* Latham.

Tribe BOPYROIDEA

Probopyrus alphei Richardson

From the branchial chamber of a snapping shrimp, *Crangon heterochaelis* (Say), a female and her attached dwarf male were taken on July 29.

Probopyrus pandalicola (Packard)

From the branchial chambers of about 500 *Palaemonetes carolinus* Stimpson, taken at Mortons Mill Pond on July 2, 52 females were taken and 50 of these bore dwarf males.

Leidya distorta (Leidy)

Between May 28 and July 10, 435 fiddler crabs (*Uca pugilator* (Bosc)) were examined. In the branchial cavities of some of these 7 female and 5 male Leidyas were found. During August Dr. Martin Burkenroad brought in four fiddlers that he picked up after dark, as he observed that they were sluggish and appeared to be "sick." Three of these also contained Leidyas.

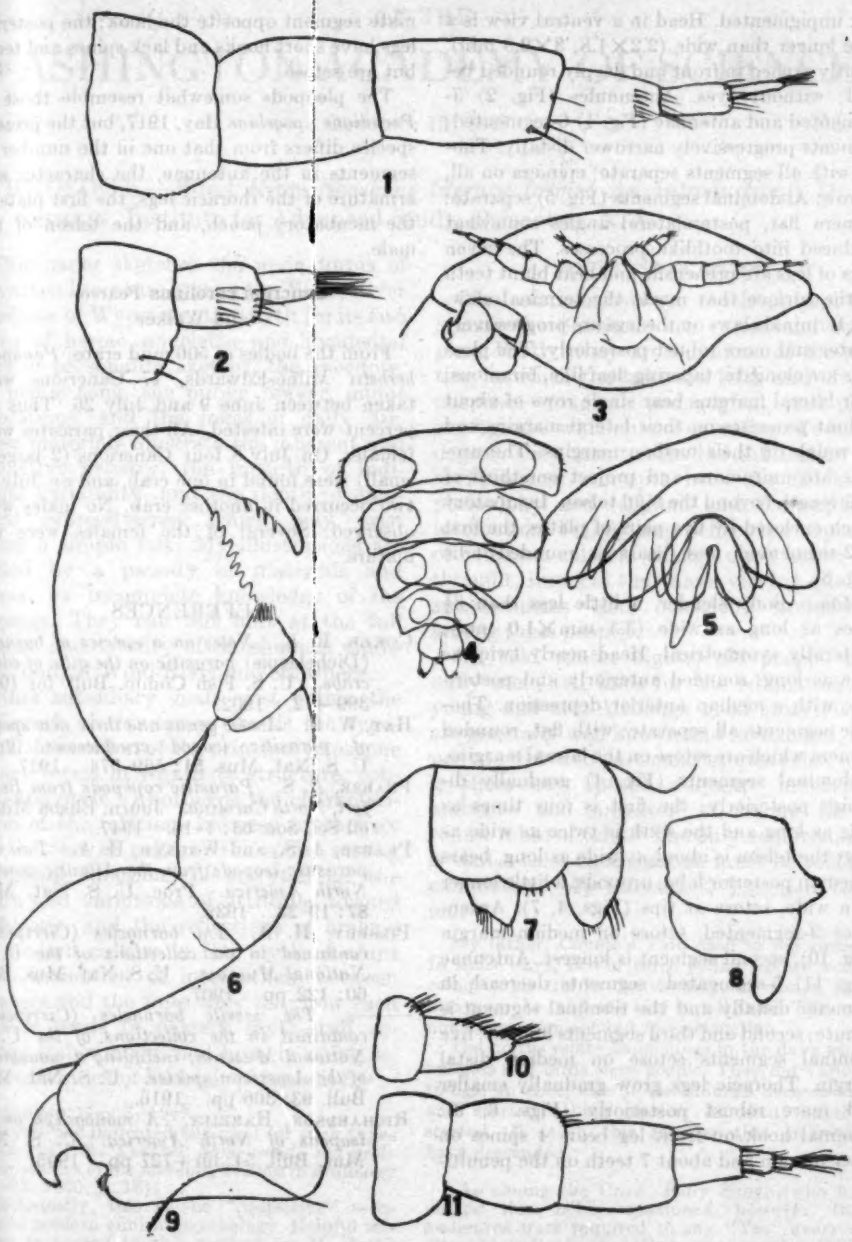
Pseudione upogebiae Hay

May 30 to August, 89 *Upogebia affinis* (Say) were examined and yielded 9 female and 7 male Pseudiones, 6 nematode worms; and in their burrows were also found 3 polyclad worms and 4 *Pinnixa cristata* Rathbun.

Pseudione panopei n. sp.

Between June 9 and July 26, 506 individuals of *Panopeus herbstii* Milne-Edwards were examined and no parasites of this species were found but on August 22, 2 large females, 3 small females, and two males were taken from the branchial cavities of 25 crabs. The holotype female (U.S.N.M. no. 82669), allotype male (U.S.N.M. no. 82670), and a paratype female (U.S.N.M. no. 82671) have been deposited in the U.S. National Museum.

Female.—Body, somewhat asymmetrical, longer than wide (13.5×8 mm; 12.5 × 8 mm);



FIGS. 1–11.—*Pseudione panopei*, n.sp.: 1, Antenna of female; 2, antennule of female; 3, head and first leg of female; 4, posterior portion of abdomen of male; 5, posterior portion of abdomen of female; 6, first leg of male; 7, telson and uropods of male; 8, first plate from incubatory pouch of female; 9, fifth leg of male; 10, antennule of male; 11, antenna of male.

flat; unpigmented. Head in a ventral view is a little longer than wide (2.2×1.8; 3×2.8 mm), slightly arched in front and deeply rounded behind; without eyes. Antennules (Fig. 2) 3-segmented and antennae (Fig. 1) 6-segmented; segments progressively narrower distally. Thorax with all segments separate; epimera on all, narrow. Abdominal segments (Fig. 5) separate; epimera flat, posterolateral angles somewhat produced into toothlike processes. The seven pairs of legs are prehensile and bear blunt teeth on the surface that meets the terminal claw. The terminal claws on the legs are progressively shorter and more robust posteriorly. The pleopods are elongate, tapering, leaf like, biramous; their lateral margins bear single rows of about 9 blunt processes on their lateral margins and are rough on their median margins. The uropods are uniramous and project one-third of their length beyond the bifid telson. Incubatory pouch enclosed by five pairs of plates, the first is 2-segmented and bears a rounded lobe (Fig. 8).

Male.—Body slender, a little less than 3½ times as long as wide (3.3 mm×1.0 mm); bilaterally symmetrical. Head nearly twice as wide as long, rounded anteriorly and posteriorly, with a median anterior depression. Thoracic segments all separate; with flat, rounded epimera which are setose on the lateral margins. Abdominal segments (Fig. 4) gradually diminish posteriorly; the first is four times as wide as long and the sixth is twice as wide as long; the telson is about as wide as long, bears a median posterior lobe; uropods, a little longer than wide, setose at tips (Figs. 4, 7). Antennules 3-segmented, setose on median margin (Fig. 10), second segment is longest. Antennae (Fig. 11) 6-segmented; segments decrease in diameter distally and the terminal segment is minute; second and third segments longest; five terminal segments setose on median distal margin. Thoracic legs grow gradually smaller and more robust posteriorly (Figs. 6, 9); terminal hook on front leg bears 4 spines on inner margin and about 7 teeth on the penultimate segment opposite the hook; the posterior legs have short hooks and lack spines and teeth but are setose.

The pleopods somewhat resemble those of *Pseudione upogebiae* Hay, 1917, but the present species differs from that one in the number of segments in the antennae, the character and armature of the thoracic legs, the first plate of the incubatory pouch, and the telson of the male.

Cancrion carolinus Pearse and Walker

From the bodies of 506 mud crabs, *Panopeus herbstii* Milne-Edwards, 17 Cancrions were taken between June 9 and July 26. Thus 3.4 percent were infested. All these parasites were females. On July 8 four Cancrions (2 large, 2 small) were found in one crab, and on July 29 two occurred in another crab. No males were observed. Several of the females were immature.

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